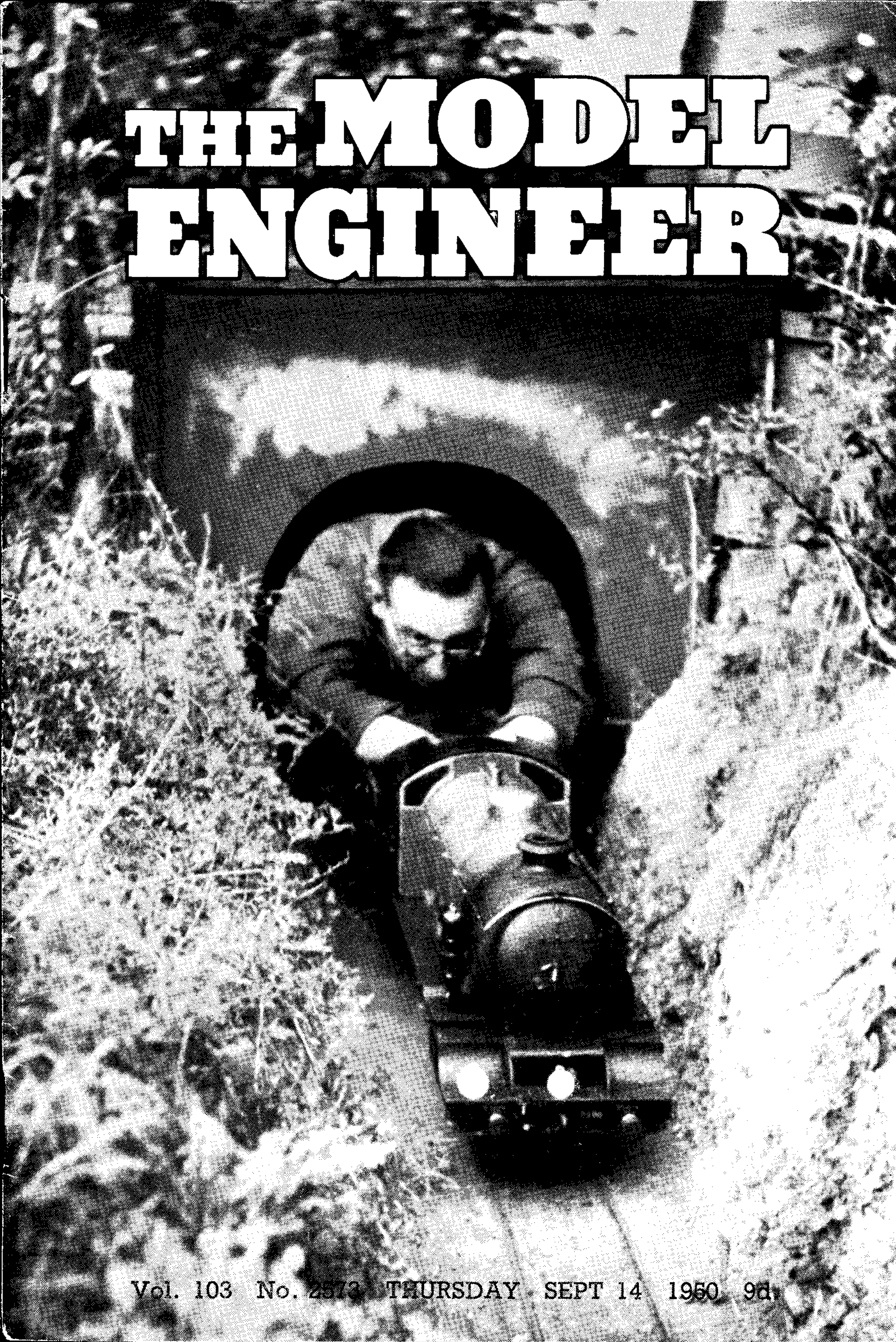
THE MODEL ENGINEER



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The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

14TH SEPTEMBER 1950 VOL. 103 NO. 2573

SMOKE RINGS

Our Cover Picture

● THE PHOTOGRAPH reproduced this week illustrates something of a tight fit! It was taken by Mr. P. G. Dupen, of the Romford Model Engineering Club, during a visit to Mr. J. J. Clarke's $4\frac{13}{16}$-in. gauge track at Hatfield Peverel. The engine is a 1-in. scale reproduction of the L.N.E.R. "Sandringham" class 4-6-0, and is being driven by Mr. E. Powell, of the Buckhurst Hill Model Engineering Club, who was travelling at about 5 to 6 m.p.h., with steam shut off because the track emerges from the tunnel on a down-grade towards some facing points. At the time, Mr. Powell was unaware that the photograph was being taken, and his concentrated expression suggests that he was fully concerned with other matters. And no wonder, because Mr. Clarke's line is equipped with a complete signalling system, and this, combined with the attention which must be given to a large-scale locomotive when she is travelling at speed, means that little or no time is available for anything else. Add the smell of coal and hot oil, and the enjoyment of the amateur engineman is complete.

Can Anybody Help?

● MODELS WILL, naturally, be well to the fore in the forthcoming Festival of Britain, 1951, and we hear that some of the specially-required ones are proving extremely difficult to find. One of these is a model of a Blackwall Frigate; do any of our readers know where such a thing is to be found? If possible, it should be a builders' model to 1/48 scale, but a privately-owned one of about the same size would meet requirements.

We are inclined to doubt whether the builders of the Blackwall frigates would have built an official builders' model; such things were not usually made in those days. But if any reader happens to know where a model of this particular type of craft is to be obtained on loan for the duration of the festival, would he please let us know immediately?

Inventors' Exhibition

● THE SOCIETY OF INVENTORS will be holding an exhibition in conjunction with the *Evening Chronicle* Better Housekeeping Exhibition, in the City Hall, Manchester, from October 17th to 28th next.

All inventors are invited to enter their inventions, for which medals and a challenge cup, kindly donated by Provincial Exhibitions Ltd. and Kemsley Newspapers Ltd., will be awarded to those voted best in their classes. Full particulars can be obtained from C. Marland, 26, Granby Road, Mile End, Stockport, Cheshire.

The "Keen Challenge Cup"

● WE ARE very pleased to announce that an additional trophy has been added to those which are competed for at the "M.E." Exhibition. Although Mr. G. P. Keen is so widely known as, first, a life-long model railway enthusiast and, secondly, as president of the Model Railway Club since its inception nearly 30 years ago, he is, nevertheless, an astute judge of good modelling of any kind.

When making a preliminary tour of this year's exhibition, Mr. Keen was struck by the fact that in the Ships section, there were some excellent examples of power-driven model steamers, but, it seemed, there was no special trophy to be won in this class. He promptly presented a silver cup to be awarded subject to certain conditions; these are: That the cup shall be competed for annually and awarded to the best working model steamer (power-driven prototype vessel), a principal consideration being that the maximum number of parts shall have been made by the competitor. This will stimulate and encourage an important and popular branch of our hobby, and we know that lovers of steamers will be deeply gratified by Mr. Keen's generosity.

Those Finishing Touches

● IN A recent issue of our contemporary, *The Motor Cycle,* we came upon the following note by the well-known writer "Torrens":—

"On the day I write this I visited THE MODEL ENGINEER Exhibition. As usual, I could only spend a couple of hours, whereas I would have been happy for a dozen. Also as usual, I was rather disappointed at the finish of many of the amateur-built models. Folk will not take the trouble to put the finishing touches on their work. It is the same with amateur mechanics of a motor cycle variety. Anything we make for our motor cycles should invite the query, 'Where did you buy it?' Then—and only then, I suggest—have we attained the standard to which we should aspire."

There is little to complain of in this comment, though we would be very interested to read what our friend "Torrens" would write if he could spend a dozen hours at the Exhibition. The comment which we have taken the liberty of quoting, however, contains food for thought. First, coming from an independent source, it should help to drive home a point which we have made, many times; the question of the proper amount of finish to be put into a model is an important one which seems still to be misunderstood by many modellers. We so often find that either the finish is very poor, if not hopelessly bad, or else it soars to the opposite extreme and is much too good to give a really convincing effect. Just the right amount is by no means as common as it should be, and we cannot resist the impression that too little thought is given to the matter. This was clearly in the mind of "Torrens" when he wrote: "Anything we make for our motor cycles should invite the query, 'Where did you buy it?'." The same query should, in a general way, be invited by anything we make for our models. Many finished parts and fittings for our models *can* be bought, but it is seldom that their finish is either hopelessly bad or ridiculously good; in the majority of cases it lies about half-way between the two extremes and, therefore, is just right.

In our opinion, a proper amount of finish, for either paint or unpainted metal, wood or other material, is one which ensures, first, a neat and tidy appearance; secondly, good working properties, and, thirdly, that some care and thought have been given to the matter.

No Place Like Home

● A RECENT letter from Mr. W. E. Martin, who is at present in Rhodesia, once more calls attention to the unfortunate lot of the model engineer in parts of the world where supplies of tools and materials are scanty, or non-existent. There are many of us in the "Old Country" who grumble and grouse at the setbacks and frustrations which we experience today; but do we ever give a thought to what others of our fraternity have to face? Some recently published "Smoke Rings" written round this subject seem to have been a revelation to several readers, one of whom wrote to tell us that, after reading our notes, he had made up his mind never to grumble again.

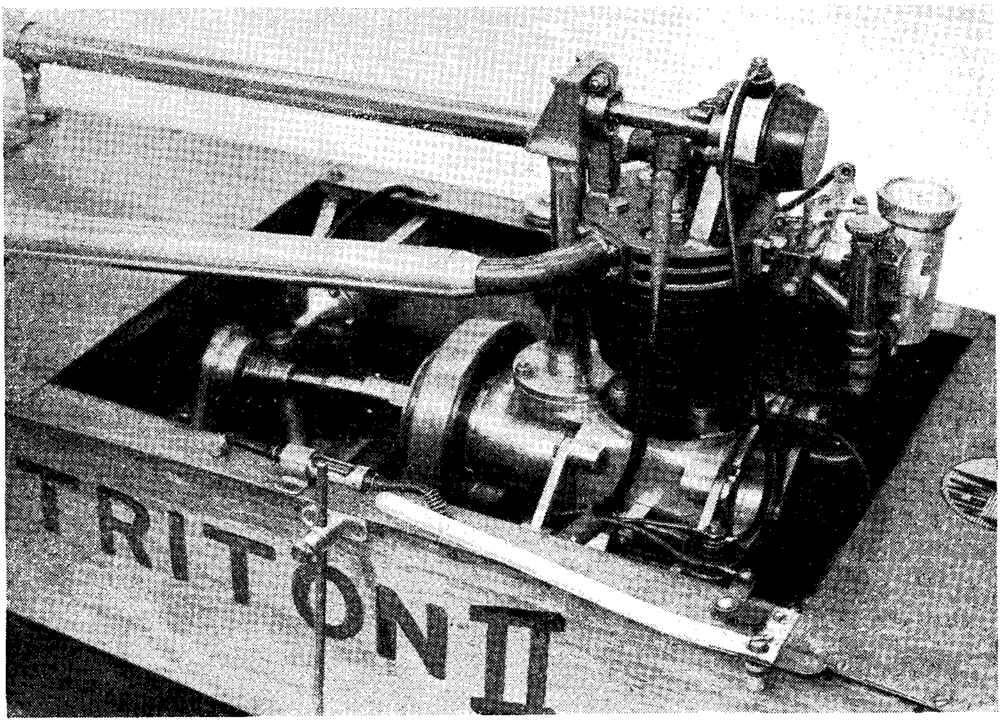
But to return to Mr. Martin's letter, he writes: "You might be interested to know that, some time ago, a Mr. Nolan inserted an advertisement in the *Bulawayo Chronicle,* to the effect that he was interested in starting a model engineering club and wished other enthusiasts to contact him. As most of my 'model engineering' is confined to making toys for my children and repairing the odd clock, I have not done so myself. I can see that any model engineer out here is sadly handicapped by lack of suitable small tools; as an example, I am unable to buy a No. 60 drill at any of the various shops here, all carrying an impressive array of engineers' tools in general. At one shop, the man in charge could not remember seeing one, and was frankly incredulous when I remarked that drills were made down to size No. 80.

"The general experience here is that, in most tool and engineering shops, the fellow in charge is just a salesman and has not a great deal of knowledge of the appliances he has for sale. So I am looking forward to a year next October, when I sail for England, home and beauty, and that well-stocked and equipped workshop I have promised myself for a long time, and to the 1952 'M.E.' Exhibition."

Of course, there are plenty of places in England where such things as No. 60 drills cannot be bought straight away and have to be sent for from other dealers; but that is better than not being able to get them at all. The purchase of certain materials, also, often involves the exercise of considerable patience while waiting for delivery, but they *do* arrive eventually. We can well appreciate, however, that even these conditions are attractive to people like Mr. Martin, and we hope that when, at long last, he has his workshop, he will have plenty of leisure in which to use it.

*I.C. Engines at the "M.E." Exhibition

THE few examples of i.c. engines which were seen installed in powered models presented little of real interest. Most of them were of commercial manufacture (this, apparently, was the universal rule in the case of power-driven aircraft models), but a notable exception was the 15 c.c. overhead-camshaft engine in the one example of a racing hydroplane by G. D. Reynolds already referred to, and illustrated herewith.



The 15-c.c. overhead camshaft engine of G. D. Reynolds' hydroplane

It is, perhaps, a disputable point whether the experimental hot air engine by R. J. Harrison should be classed as an internal combustion engine; this definition certainly does not apply to the usual type of hot air engine, where combustion takes place entirely external to the working cylinder. In this particular case, however, the effective heat which produces the driving force is produced by combustion inside the cylinder.

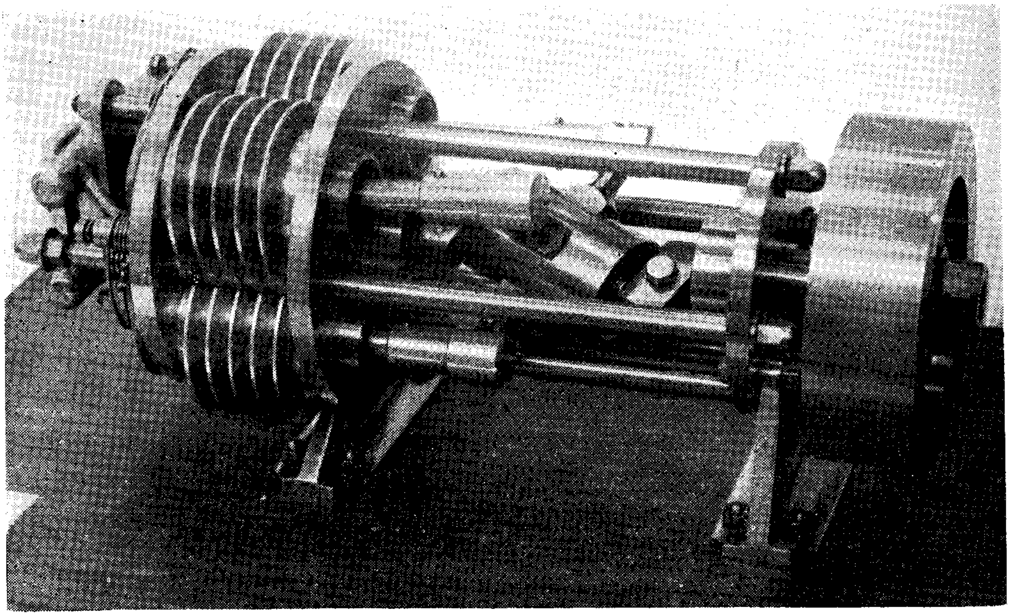
The working principle of this very interesting engine is as follows: each cylinder is provided with a swinging shutter which serves as a valve, and also a gas jet or other form of burner which is directed into the bore of the cylinder. During the outward stroke of the piston, the valve is open and the flame burns inside the cylinder, instantaneously heating the air therein to a very high temperature. At or near the end of the stroke, the valve is closed, and the enclosed air, isolated from the heat of the burner, is cooled equally rapidly, so that the pressure falls below that of the outside atmosphere; the latter, acting on the outside, or "underside" of the piston, presses it inwards. It may, therefore, be said that this constitutes a form of "vacuum engine."

While the basic principle of this engine is not new, and was, in fact applied to fairly large industrial engines in the heyday of the hot air engine, its particular application to a multi-cylinder axial type engine is apparently novel, and highly ingenious. This engine employs the principle of the "Z crank." which is one of the variants of the swashplate, and produces the same order of motion. It is observed that the crankshaft in this case is of the built-up type,

*Continued from page 357, "M.E.," September 7, 1950.

and has evidently called for great skill and care in machining ; the crank bearing is in the form of a cylindrical bush having four equally-spaced radial arms, with spherical ends to which the connecting-rods are universally articulated. In engines of this type, it is necessary to prevent the entire "spider" assembly creeping round and twisting the rods out of alignment with the cylinders ; this is done by using one of the tie rods, which connect the cylinder and main bearing plates, as a guide rod to control the motion of a fork attached to the sleeve between the arms. The valves are controlled by a single cam on the rearward extension of the main shaft.

This was certainly one of the most interesting mechanical exhibits in the entire competition section, and also a good specimen of precision engineering ; the only possible criticism one can offer is that so much skill and ingenuity was expended—we will not go so far as to say "wasted"—on a type of engine which has such inherent limitations that it cannot possibly be very efficient, either in a thermal sense, or in respect of power in relation to size. Perhaps the constructor (or some other equally competent worker) will apply the same mechanical principles to a true internal combustion engine, either of the two-stroke or four-stroke type, at some time in the near future.



R. J. Harrison's axial-type four-cylinder hot air engine

Loan Exhibits

There were two i.c. engines worthy of notice in this section ; the first was the 30 c.c. marine power plant by Mr. R. O. Porter, of Virginia Water, and the second was the Atkinson "E.A.M." 47 c.c. cycle unit by G. Goodyear.

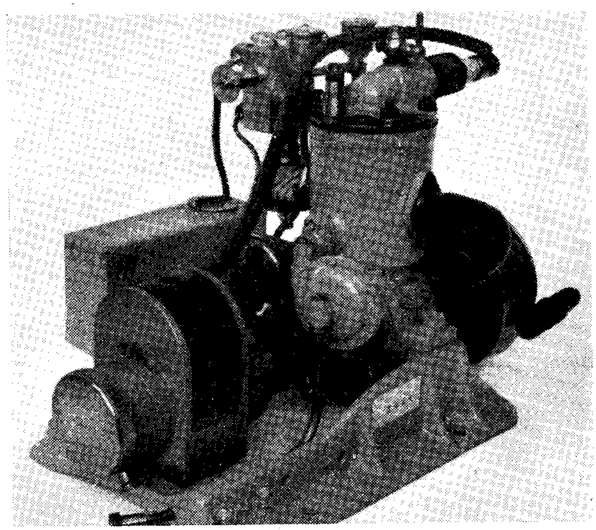
Mr. Porter's engine is an early Stuart Turner two-stroke—a clue to its date may be found in the fact that it employs a full size sparking plug ; miniature plugs of any kind were unheard of at the time it was produced. It has seen many years of yeoman service in Mr. Porter's cabin cruiser *Slickery*, and is still a consistent and reliable worker. A gear-driven centrifugal pump is fitted for water circulation, and ignition is by means of a commercial miniature magneto, of a type not now obtainable. The carburettor is a comparatively recent fitting, of ingenious design, which was described by Mr. Porter some weeks ago in THE MODEL ENGINEER. A self-winding starter, operated by a leather strap, is provided. It will be observed that the entire unit is mounted on a sub-base casting, which is secured in the boat by four bolts and is thus easily removable for overhaul or adjustment.

Trade Section

A very large variety of small compression-ignition and glow-plug engines, of all the well-known established makes, was featured on the stands of Messrs. E. Keil & Co., Ltd., H. J. Nicholls Ltd., Z.N. Motors, Ltd., and Mercury Model Aircraft Supplies Ltd. The range of "E.D." engines and accessories, including the "M.I.-E.D." miniature magnetos, were shown by Electronic Developments (Surrey) Ltd. Messrs. Stuart Turner Ltd., displayed their well-known pre-war lines of castings and finished engines, including the Sandhurst horizontal engine, which is now almost the only survivor of

a once popular type. There is a strong case for revival of interest in the older forms of horizontal stationary engines, which were very interesting to build, reasonably certain in operation, and useful for carrying out everyday duties when completed.

Among the showcase exhibits, the "C.I. Special" 10 c.c. four-stroke engines by J. & G. Jensen Ltd., were of special interest. These engines, which were introduced for the first time at last year's exhibition, represent the only known example of a commercial four-stroke model racing engine at present in production, and are highly efficient and reliable; they are obtainable

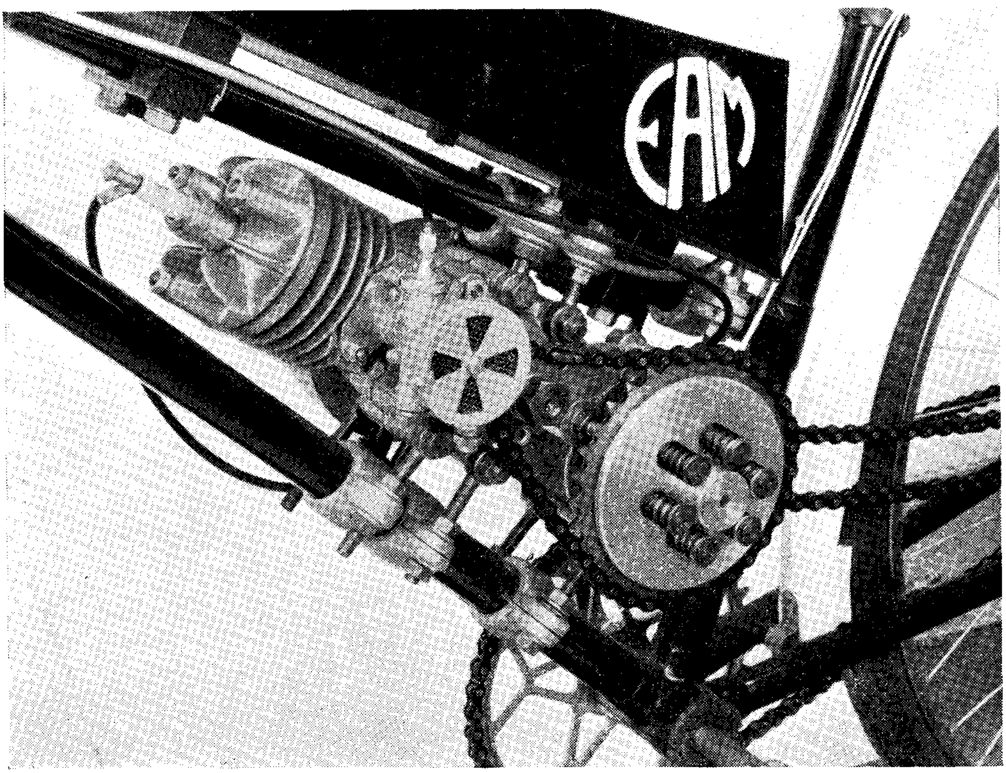


R. O. Porter's marine power plant

either in the finished state, or in castings and parts. The Atkinson 47 c.c. cycle engine unit (already mentioned) was also featured, in the form of a set of castings and ports. The unit consists of a four-part "flat top" two-stroke engine of $1\frac{1}{2}$ in. bore by $1\frac{1}{2}$ in. stroke, in conjunction with a chain-driven ball bearing countershaft, incorporating a plate clutch. It is designed to fit in the frame of an ordinary cycle, driving on the back wheel by chain and sprocket gear.

The most comprehensive selection of castings and parts for model i.c. engines of all types and

(*Continued on page* 397)



The "E.A.M." motorised cycle unit, by G. Goodyear

Workshop Equipment
at the "M.E." Exhibition

ALTHOUGH there are no very outstanding developments in the field of workshop equipment, some of the new exhibits reach a high standard of achievement and will appeal to the owner of a small workshop. However, popular disapproval of some of the lower-grade machines has contributed to their early demise. Undoubtedly, as mechanical perception continues to be developed, so the indifferent machine will become less salesworthy and will, let us hope, ultimately disappear, and thus no longer sully our engineering reputation in both the home and export fields.

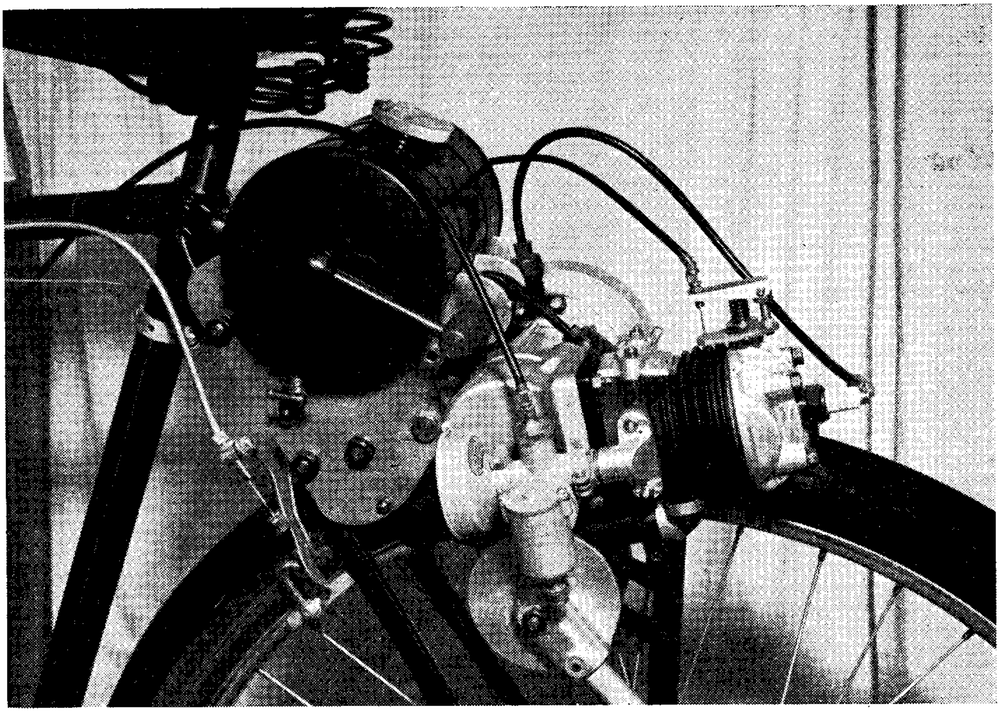
This question of quality is of paramount importance in the small workshop, for an unsound machine, whatever its price, can never give lasting satisfaction or be capable of maintaining accuracy of performance. When it comes to selecting a machine, the position of the lone worker of small mechanical experience may, indeed, be difficult ; he can, however, seek the advice of a knowledgeable friend, or he may find that the machine in question has figured as the subject of a Test Report in this journal.

But let us return to the Exhibition, and see what there is in the way of new and attractive exhibits, and how some of the well-established machines have fared since the previous show took place.

A visit to Messrs. Myford's stand showed at once that they have no intention of resting on their reputation. Here was a display organised to show the ML7 and the wood-working ML8 lathe in operation. Examples of metal work consisted in demonstrating the machining of the components of a small petrol engine for attachment to an ordinary pedal cycle. The fact that this 50 c.c. engine, named the "Busy Bee," has been designed by Mr. E. T. Westbury, should be a sufficient guarantee of its sound construction and satisfactory performance.

Accompanying this practical demonstration was a series of excellent photographs showing the various set-ups employed for machining the parts. These photographs, we gather, may be reproduced to illustrate an instruction manual for the guidance of Myford lathe users, thus helping the less-experienced worker to operate his lathe to the best advantage.

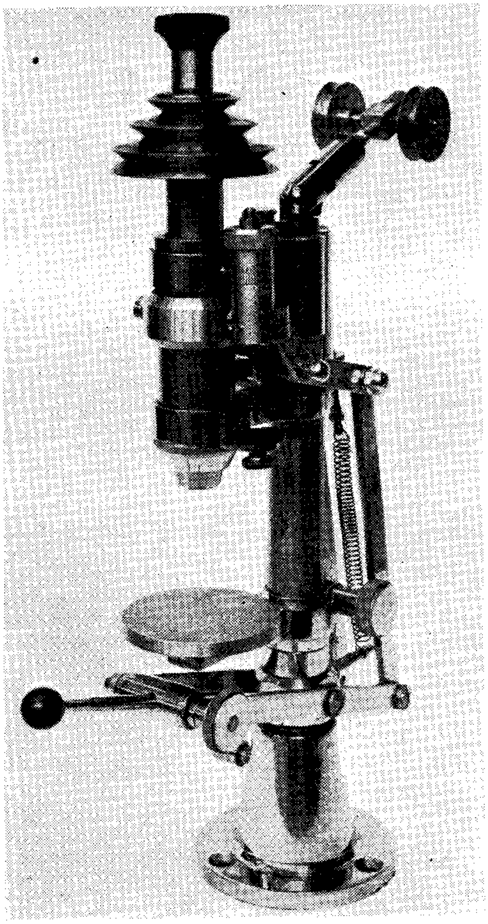
As one of the original stand-holders at the



The "Busy Bee" pedal cycle motor

exhibition, Messrs. Buck and Ryan had, as usual, a fully representative display of serviceable machines and hand tools; it will, however, be possible to allude to only a few of the exhibits which attracted the attention on both this and on other stands.

The Pool bench milling-machine has been improved by re-designing the spindle and its bearings to afford greater rigidity. The 3-step pulley mounted on the spindle is driven by twin V-belts, and, although this undoubtedly gives an efficient drive for operating the machine at medium and fast speeds, the fitting of a back gear would enlarge the scope of the machine and enable it to deal successfully with the great variety of work undertaken in the small workshop. The long feed shaft actuating the knee slide, although well-suited for its purpose, appears perhaps, a little unusual to those accustomed to a more compact form of construction, such as is obtained by operating the feed-screw by means of a horizontal shaft and skew gearing, as is commonly fitted to the larger shaping machines.



The I.M.E. precision drilling machine

It would be unreasonable to expect too much for the price at which this machine is sold, but provision could, perhaps, be made for fitting automatic feeds to satisfy those who are prepared to pay extra for this addition. At some future date, may be, we shall see a *de luxe* edition of the machine embodying some or all of these suggestions, for the manufacturers may, or may not, consider it expedient to enter a field in which there is but little competition.

The Senior milling machine has, of course, established for itself a unique position by reason of its high-grade workmanship and the excellence of its design; nevertheless, the moderate price, for a machine of this quality, is rather beyond the means of most amateur workers.

The Fobco drilling machine of ½ in. capacity appears to be a newcomer to the ranks of the motorised drilling machines. On inspection, this tool has an attractive appearance and both the design and the quality of the workmanship would seem to be quite satisfactory. As the tool is described as a precision machine, no doubt the components are finished and fitted to a higher degree of accuracy than obtains in the ordinary commercial machines of this type; furthermore, it would be expected that only a specially selected drill chuck is fitted, having a very small error of holding. These points can, of course, only be established by careful inspection and testing, but, in view of the makers' claim, they have produced a machine of quality at a moderate price and therefore deserve commendation.

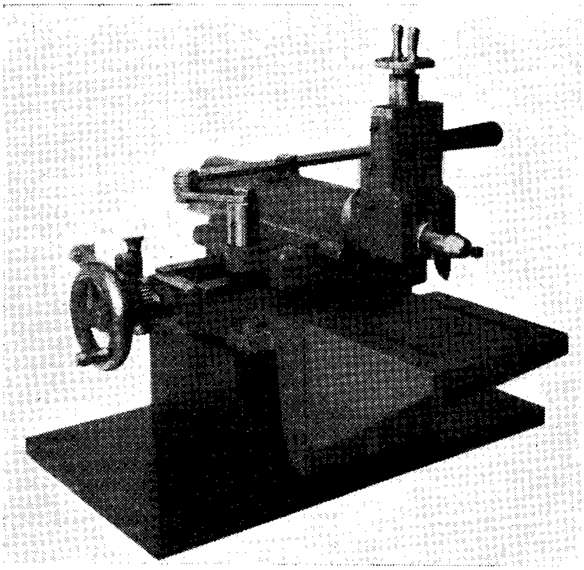
The small I.M.E. drilling machine should appeal especially to those who require an accurate machine for small work. This tool, we were given to understand, is fitted with a hardened spindle running in hardened steel bushes, as is the usual practice in small precision drilling machines of this type. The design of the feed mechanism is ingenious, and, to afford true holding, the drills are held in draw-in collets fitted to the machine spindle.

In the past, users of small lathes have experienced some difficulty in obtaining suitable self-centring 3-jaw chucks, but the new addition to the Burnerd range, a 2¾ in. diameter chuck, should, like its predecessors, give good and lasting service.

Messrs. Cowell exhibited samples of their well-known ⅜ in. capacity drilling machine. It may be remembered that a description was recently given in THE MODEL ENGINEER of how to build this machine from the excellent set of machined castings and finished parts supplied by the manufacturers. No doubt, small modifications will be introduced from time to time to improve the machine still further so as to meet the needs of the small workshop, and to render the machine even easier to build.

A small, hand-operated shaping machine of robust design was exhibited. This machine is furnished with a self-acting feed gear and should prove adequate for the requirements of those mainly concerned in the production of accurate, small and medium-size components. This shaper is, we understand, supplied in the form of machined castings, and with some of the more intricate parts in the finished state. With this policy we are in entire agreement, for in

this way, the machine can be constructed by the amateur worker to a high standard of accuracy and with a satisfying degree of finish. That is to say, the machine will be built up to a standard, whereas, were the finished machine marketed, it might possibly have to be built down to a price in order to compete with other commercial machines already in production. This is quite understandable when it is considered that, in the present circumstances, the cost of hand-fitting, and even of producing a really well-finished hand-painted surface, is almost prohibitive where the machine has to be produced at a reasonable price. On the other hand, the amateur worker may derive great satisfaction both in making and using a machine to which he himself has devoted great care in the accurate fitting of the parts and in providing them with a finish that will be pleasing to the eye, and will, at the same time, ensure a long working life.



The Cowell shaping machine

The Kerry drilling machine was shown on the stand of the Victa Engineering Co.; this drill is fitted with a back-gear which provides spindle speeds sufficiently low to enable holes to be drilled up to $\frac{5}{8}$ in. in diameter, or tapping operations to be carried out with the aid of a tapping attachment. The belt guard can be readily raised to facilitate shifting the belt when altering the spindle speed.

On the same stand, the moderately-priced Hobson lathe of $3\frac{1}{2}$ in. centre height was a newcomer, and, as it is described by the manufacturers as a precision machine, presumably the mandrel, the slides, and other parts are finished to a higher degree of accuracy than is found necessary in ordinary lathes of this class. At first sight, the saddle slides appeared to be familiar, perhaps because they are in many respects similar to those fitted to another make of lathe. The tailstock, although not of the usual precision pattern, is well-fitted and is clamped to the bed by tightening a readily-accessible clamp nut. When the headstock driving gears have been fitted, a detailed examination and trial of this interesting lathe may be found well worth while; moreover, the precision limits to which the machine is built will, it is hoped, be made known as an added attraction.

The Warwick 10-in. power-driven shaping machine, seen working on this stand, has also **been recently** introduced. At the moderate price quoted for a machine of this class, too many detailed refinements should not be expected, for the outlay is better expended in providing a sound form of general construction, and in giving a good finish to the working parts. A valuable feature of the machine is that an adjustable automatic feed is provided both for traversing the swivelling table and for actuating the vertical knee-slide. With a machine having a long stroke it is essential that the ram should continue to be well supported right to the end of the stroke; in the present instance, the ram slides are $16\frac{1}{4}$ in. in length, and it was found that, when the tool was 12 in. beyond the slide ways, the ram slide was still in engagement for a length of $10\frac{1}{2}$ in. The position of the tool in relation to the work is set by adjusting the ram on the clamp bolt attached to the crank mechanism. To set the length of the ram stroke, the crank pin is loosened with a spanner, and then adjusted to give the throw required. Although this mode of setting the tool and adjusting the ram stroke is quite satisfactory in practice, the method employed in some machines, whereby these adjustments are made with the aid of skew or bevel gears, has certain advantages; moreover, time may be saved if a graduated scale is provided to give a direct reading of the length of the ram stroke. A 2-speed gear box, in conjunction with stepped belt pulleys, is a very satisfactory way of providing four driving speeds, and the operation of the machine is facilitated by fitting a hand-operated friction clutch in the driving mechanism.

The Boxford $4\frac{1}{2}$ in. lathe Model A, which was shown by Messrs. T. S. Harrison & Sons, has now established itself as a machine tool having considerable refinements. Sixteen spindle speeds are available ranging from 40 to 1,300 r.p.m. Standard equipment with the lathe, which is supplied as a bench machine, are: fully automatic apron, quick change gear-box, compound slide-rest, driving plate, chuck back-plate for a 4 in. chuck, two morse taper centres, headstock spindle sleeve nose-cap, grease gun and wrenches.

The quick-change gear-box allows the cutting of both right and left-hand screw threads in pitches ranging from 4 to 224 t.p.i. Longitudinal feeds from 0.0015 in. to 0.0853 in. and crossfeeds from 0.0004 in. to 0.0252 in. are also obtainable through the gear-box.

Three lengths of bed are obtainable; these

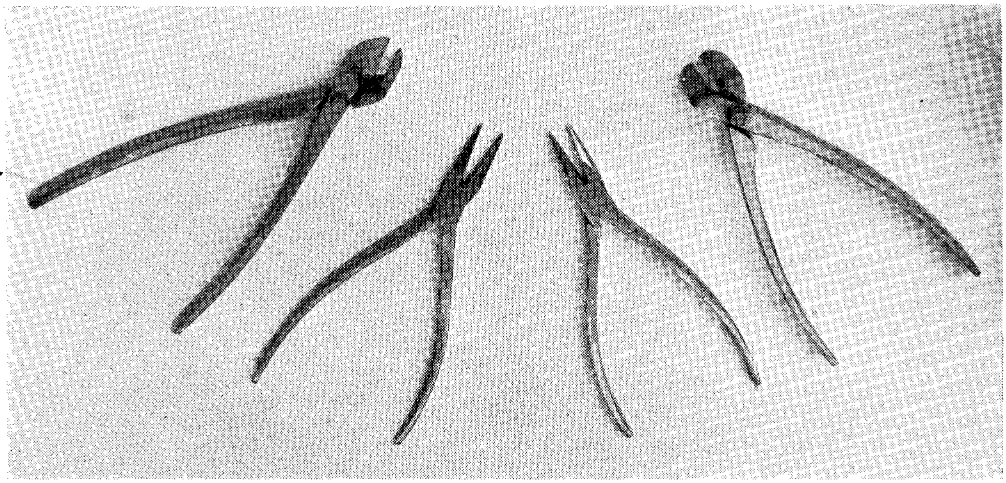
are 36 in., 42 in. and 48 in. respectively. A comprehensive range of attachments and accessories is made for this lathe and greatly increases its usefulness. Amongst these fittings may be mentioned the universal milling attachment, which is mounted directly on the lathe cross-slide, allowing either hand or power feeds to be used when machining work clamped to the vertical-slide.

The draw-in collet attachment which may be obtained for use with the lathe includes the hand-wheel and the hollow draw bar together with a tapered closing sleeve. Collets are not included in the price of the attachment; nor is the nose-cap, for this item is part of the lathe's standard equipment. A comprehensive range of collets for holding round work up to $\frac{1}{2}$ in. diameter is obtainable, and in addition, collets to hold both hexagon and square material can be supplied.

Amongst the various products of Messrs. T. S. Harrison & Sons is the Union P.D.2. $\frac{1}{2}$ in. capacity bench drilling machine. This is a machine of robust and sound construction, having rack feed to the quill, and has now been in production for many years. It is principally intended for line shaft drive, under which conditions it will fulfil many needs economically, a fact for which we can vouch by practical experience. The spindle is of $\frac{3}{4}$ in. diameter, high-tensile steel and the whole machine is designed for heavy duty.

In addition, Messrs. Harrison manufacture a comprehensive range of Union engineers' accessories, some of which were shown. These items include angle-plates, both plain and swivelling, box angle-plates, drilling machine vices, tilting tables, vee-blocks, surface plates, and, last but not least, some adjustable parallel packings which will be found invaluable when setting up work for machining. Unfortunately, it was not possible to inspect these packings as they were not included among the stand exhibits, but they appear to be somewhat wider than the American pattern at one time on the market and should therefore be easier to use when adjusting work for machining.

The Union grinding machines are well known and have now been developed as multi-purpose units for grinding, polishing and sawing. They are of robust construction and are made in two sizes, taking wheels of 6 in. and 10 in diameter, respectively. When used for sawing, saws of 6 in. and 8 in. diameter can be fitted.



Watchmaker's pliers seen on Messrs Tyzack's stand

The E.W. lathe which was seen working on THE MODEL ENGINEER workshop stand, has been designed with object of providing a simple and sturdy lathe to which additional standard features can be added when necessary. It is of $2\frac{1}{2}$ in. centre height, which is somewhat small for much of the work encountered in the amateur workshop, and it will admit 8 in. between centres. The complete novice will, however, find this lathe is a useful tool on which to gain experience before passing on to a larger machine when he has become more proficient. The bed is of interesting design, as it is angular in section, and has stiffening ribs cast on the inside of the angle. The headstock bearings are two separate units which are clamped to the bed. This design allows the manufacturers to bore each bearing separately in a jig, and final alignment of both the headstock and the tailstock is ensured by a line-reaming operation carried out with the individual components assembled on the lathe bed.

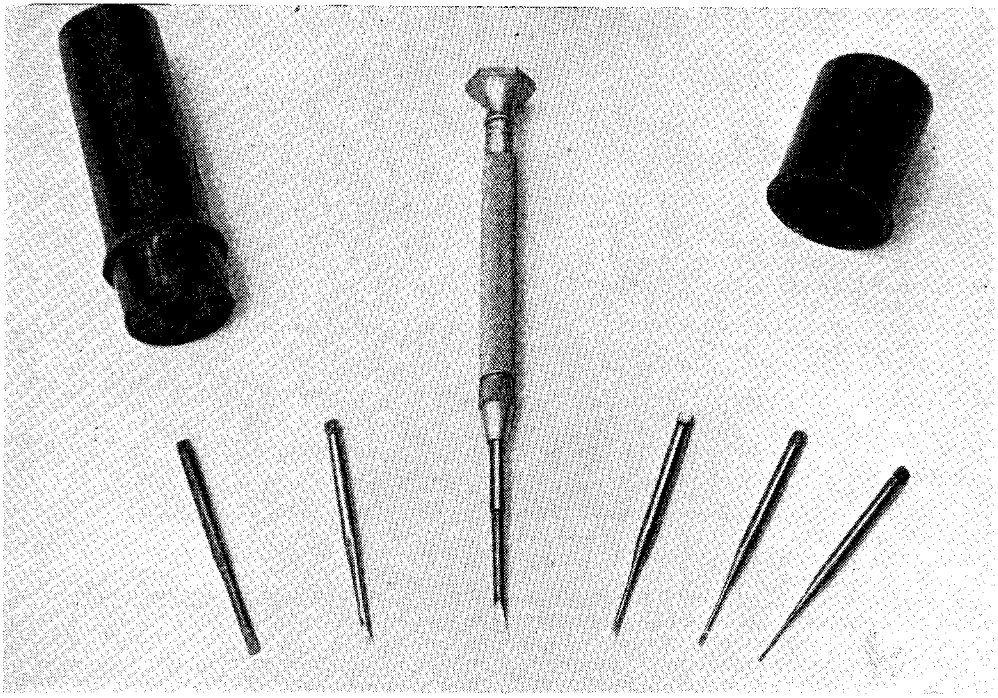
A fully compound slide-rest with calibrated hand-wheels is supplied and the top-slide which can be swivelled is also calibrated in steps of five degrees. The chuck back-plate, the catch-plate and the 3-step countershaft pulley, form part of the standard equipment.

Additional equipment which may be purchased includes an attachable back-gear, and a screw-cutting attachment comprising a $\frac{5}{8}$ in. $\times$ 8 t.p.i. Acme thread lead-screw, hand-wheel, apron, gear bracket and ten change-wheels with the necessary locking collars. At present, the lead-

screw nut is of solid form, which somewhat detracts from the ease of operating the machine; but it is understood that the manufacturers contemplate fitting a split nut to the lead-screw in the near future.

This small lathe is more robust than many other productions of a similar type and size, and it is capable of imparting good finish to work and intricate work. The head of the vice is capable of swivelling through 90 deg., whilst the turret may be rotated through a full circle, thus giving completely universal movement. The width of the jaws, which are smooth-ground to prevent damage to the work, is $1\frac{5}{8}$ in. and the jaw opening is $1\frac{1}{8}$ in.

There are two important points of construction



A watchmaker's screwdriver set by Messrs. Moore & Wright Ltd.

which is machined upon it. On THE MODEL ENGINEER stand it was seen turning the back-plate for its own self-centring chuck. This work was carried out expeditiously, and with no signs of chatter, leaving an excellent finish.

Messrs. Offen & Co. Ltd., who have not previously exhibited at the "Model Engineer" Exhibition, were showing some tools of outstanding quality. For this reason alone, the exhibits must have been of interest to all those who appreciate good equipment and first-class workmanship for its own sake. As might be expected, there were no low-priced items to be seen on this stand; but when the accuracy of the various exhibits is taken into account, the prices asked for them will be found not unreasonable. As Messrs. Offen's business is primarily the supply of equipment for use in commercial engineering workshops, they do not claim that all of their manufacturing range will be of direct practical use to the amateur. However, they have introduced a small universal swivelling vice which will undoubtedly appeal to model makers and all those who do small

which call for attention. The first point is the simultaneous clamping of both the vice head and the turret by a half-turn of the clamping screw which protrudes from the base. The second point which is noteworthy is the total enclosure of the vice lead-screw. This is a most commendable feature, as it serves to protect this part from swarf and the inevitable wear which would otherwise take place. This vice can readily be used as a light machine vice for drilling and grinding operations; for this reason, the base is machined flat on the underside to allow it to be firmly mounted on the machine table.

Messrs. Offen manufacture a very accurate vee-block which is hardened and ground to close limits of accuracy, and it can be used on all faces. The neat method of clamping, causes no obstruction and permits the vee-block to be used in an inverted position if so desired. The dimensions of the block are $1\frac{3}{4}$ in. long by $2\frac{1}{4}$ in. square, and it has a maximum capacity of 1 in. diameter round bar material. Messrs. Offen supply these tools either singly, or in matched pairs when required.

Though possibly of less practical interest to the amateur, some precision toolmakers' vices must be noted. These are precision tools designed primarily for use with magnetic chucks on surface grinders and ought not to be used for rough work, for their high cost would be money wasted in such circumstances. There are many points of interest in the construction of these vices, notably the total enclosure of the operating screw, which is thus protected from abrasive material. The slide upon which the moving jaw is fitted is dovetailed, which gives rigidity and ensures that the jaws remain parallel all the time. All parts are hardened, a feature which serves to protect the tool from accidental damage, and a groove is machined all round the base so that the vice can be clamped to a machine table if necessary. In order that any shake which may develop in the moving jaw can be eliminated, the slide upon which it travels is made adjustable for wear. Three sizes of vice are manufactured having jaw widths of $1\frac{1}{4}$ in., $1\frac{7}{8}$ in., and $2\frac{1}{2}$ in. and jaw openings of 1 in., $1\frac{1}{2}$ in., and 2 in. respectively.

The Kennedy Bending Machine, which has quickly gained popularity since last year's exhibition, was again demonstrated by the makers who have had the foresight to supply complete kits of materials for constructing this useful little tool, as well as offering complete bending machines to those who have neither the time nor the inclination to make it for themselves. Examples of bending in metals of various kinds and sections were demonstrated and these served to show most convincingly the practical value of the device.

The quality and finish of small hand tools continues to show improvement. On Messrs. Tyzack's stand a comprehensive display of small tools was seen. Amongst these a new range of watchmaker's pliers was noted. They are obtainable in five varieties, and are bright finished all over. They are a great improvement on what has hitherto been obtainable, but there are one or two points in their construction which call for attention. It was noted, for example, that the cutters did not close squarely, and that, in one or two instances, the joints could have been somewhat firmer. These are points which naturally detract from the general finish, and we have no doubt that the manufacturers will give them attention. However, unquestionably, these tools will appeal to those who do fine work, and for whom the supply of suitable pliers has been, for a long time, largely non-existent.

The watchmaker's screw-driver set manufactured by Messrs. Moore and Wright, has now been supplemented by a new set No. 777/2 which was seen on Messrs. Tyzack's stand. The new kit dispenses with the provision of a separate holder for each size of screw-driver blade. Instead, a single holder with interchangeable blades is supplied, the whole being mounted in a compact moulded plastic case.

Also on view at Messrs. Tyzack's stand was a 1-oz. hammer which will be found useful for light work. It is well finished and nicely balanced and would be a useful addition to any tool-kit.

I.C. Engines at the "M.E." Exhibition

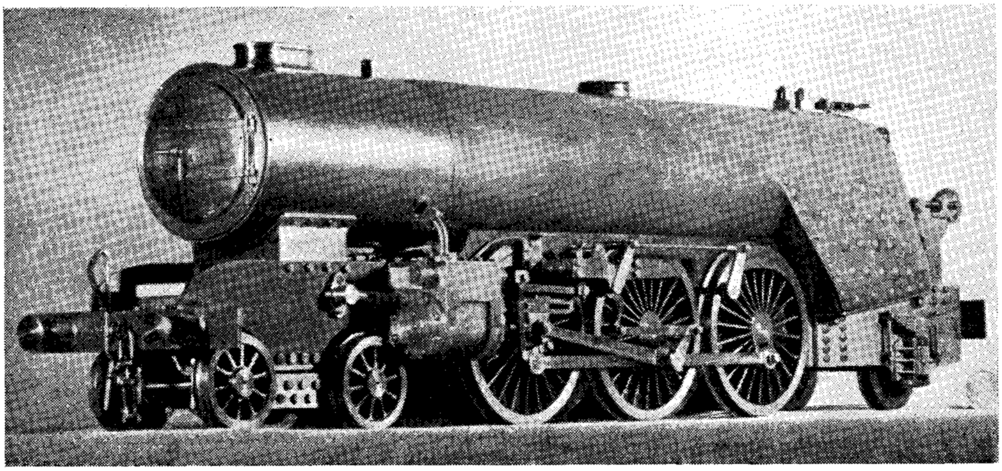
(*Continued from page* 391)

sizes was that shown by Craftsmanship Models, Ltd., as the designs of these engines have all been featured in THE MODEL ENGINEER, and are well known to readers, it is not necessary to refer to them in detail. Mention, may, however, be made of the castings for the "Seagull" 10 c.c. twin engine which is now being described in "Petrol Engine Topics." In this case, sand castings of an approved quality are used, but in several of the smaller engines of popular design, die castings are available.

A feature of special interest to i.c. engine enthusiasts was the demonstration of machining engine components on the Myford stand. The type of engine selected for this demonstration was the "Busy Bee" 50 c.c. auxiliary engine, which is sufficiently large in the size of essential parts to present problems to the users of small lathes; but it was convincingly demonstrated that all the castings and other parts can be handled quite efficiently on the Myford ML7 lathe. It is, perhaps, opportune to observe that the Myford Engineering Co. are not interested in the commercial exploitation of this engine, either in the complete form or in sets of castings; but the latter will be available from Messrs. Braid Bros., of Hackbridge, Surrey. As the engine will be the subject of a complete description in later issues of THE MODEL ENGINEER, there is no need to deal with it in detail in this review.

The general conclusions to be arrived at from a survey of i.c. engines, in all sections of the exhibition, is that healthy progress in design is being maintained, and there are many amateur constructors who are interested in building engines of the more complex and advanced types, but individual design and construction of engines for racing and other competition power-driven models shows a tendency to decline, or to be superseded by the commercially-produced engine. This is particularly the case in model racing cars, and one cannot escape the conclusion that there is a danger of degeneracy in this particular field. However, it is possible that some of the best examples of racing engines never appear at the "M.E." Exhibition, owing to the exigencies of the constant development, tuning and maintenance which these engines require. This is well known to be the case with speed boat engines, and the fact that one of the most important regattas of the season takes place immediately after the exhibition, deters many constructors from displaying them.

However, there is no denying the increasing popularity of the i.c. engine in most, if not all, of its many forms, and one still cherishes the hope that it will eventually achieve "proportional representation" in future "M.E." Exhibitions.

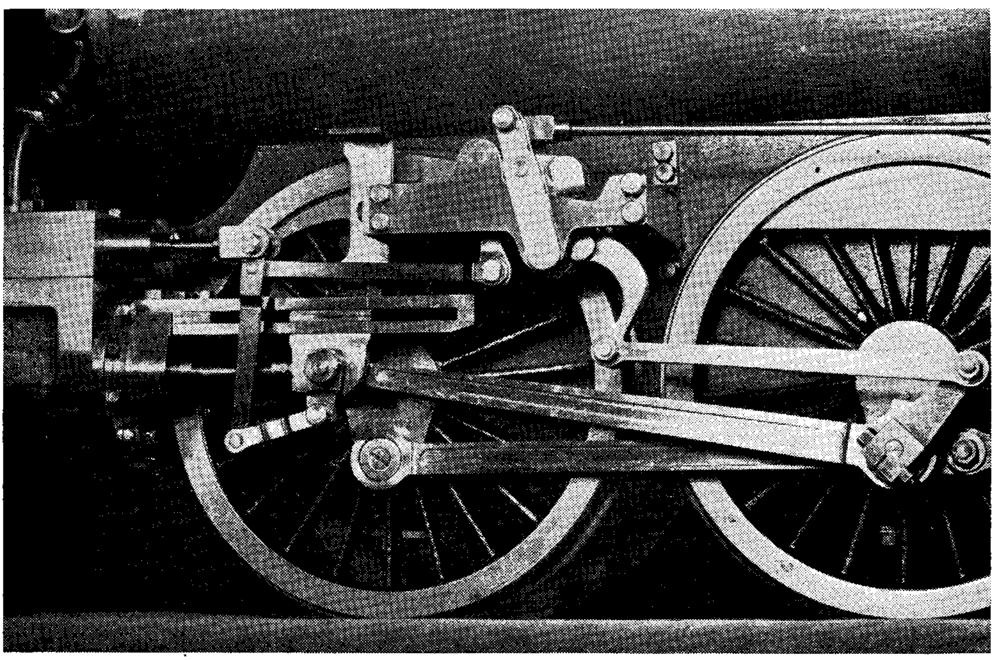


A Fitter's "Hielan' Lassie"

by S. Plummer

THE photographs reproduced with these notes show my "Hielan' Lassie" in course of construction. To give a description of the work so far is not easy because I did not deviate to any extent from the excellent and concise articles by "L.B.S.C." In fact, I never intended building a locomotive, probably because, for a number of years, I was a locomotive maintenance fitter.

However, reading through the back volumes of the "M.E." about 18 months ago, the interesting articles by "L.B.S.C." on the "Hielan' Lassie" aroused my enthusiasm. The photographs show the progress made in these 18 months, and represent about 1,000 hours' work.

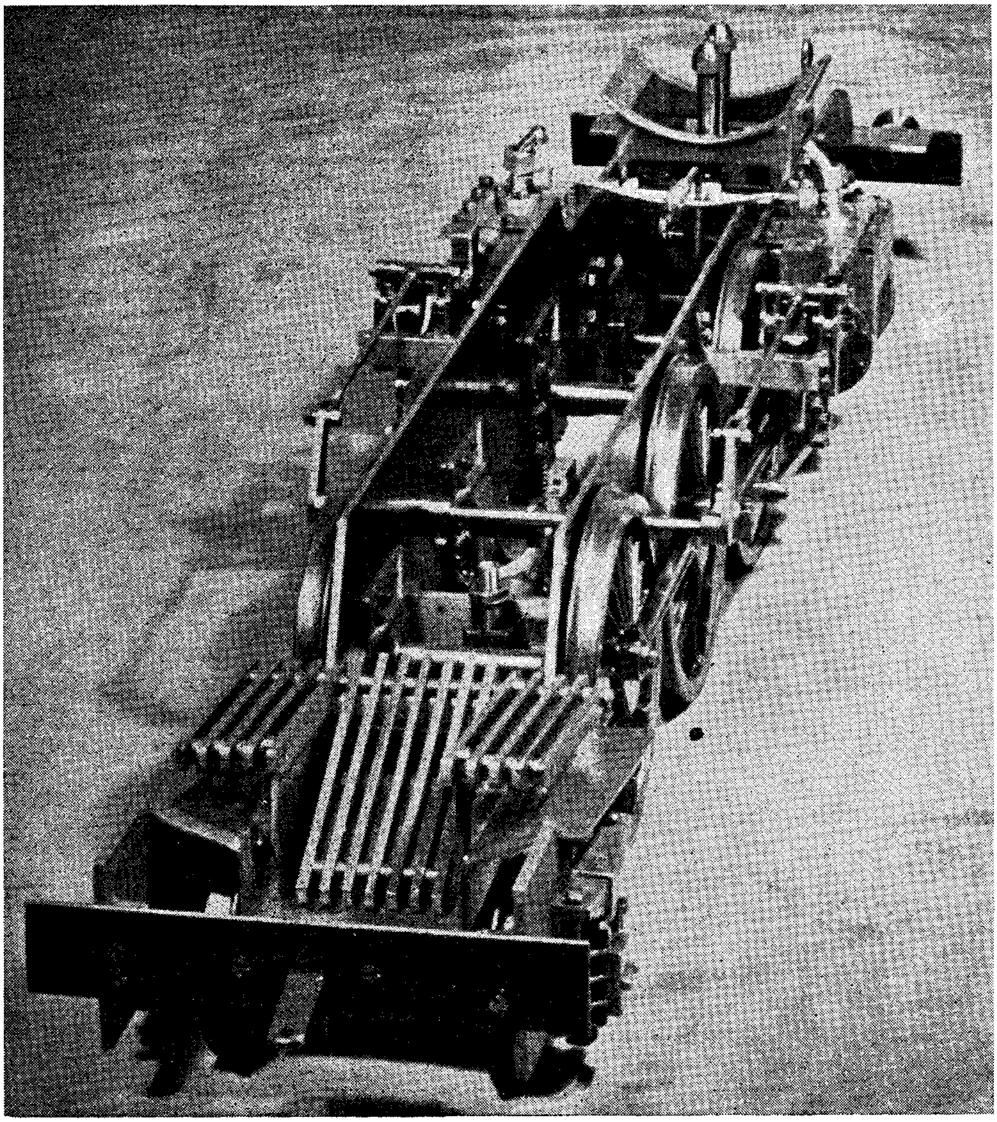


Close-up of the Baker gear

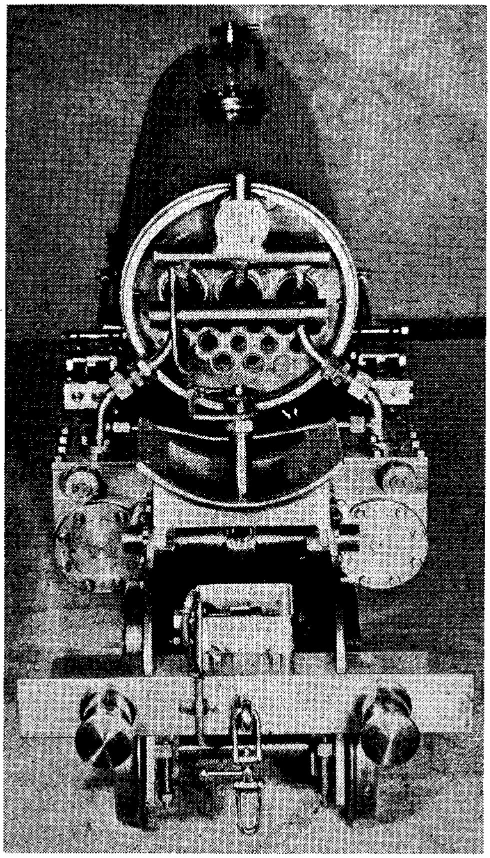
The boiler gave me the most trouble. I have a five-pint blowlamp but could only get sufficient heat for brazing with the greatest effort. After brazing one or two joints I wrote to "L.B.S.C." and got his advice and O.K. for using "Easyflo," with a test pressure of 180 lb. sq. in. From then on everything was straightforward.

An Expensive Business

Undoubtedly, using first-grade silver-solder is an expensive business, but as the stresses created by expansion and contraction in a boiler are considerable, it is very necessary to use first-grade, such as "Easyflo," as it is very strong (30 tons per sq. in. tensile) and very ductile (30 per cent. elongation) whereas a coarse grade can have an elongation as low as 5 per cent. One very important point to note, if silver-solder is used, is that its fluidity is much greater than brazing strip, and joints must be a really close fit, otherwise the silver-solder will run through like water. To ensure that the flanged and lapped joints were in close contact, I annealed all sections, fairly close riveted and then beat down the joints into full contact everywhere. Under these conditions it was possible to get full penetration and



Rear end of chassis, showing rocking grate



Smokebox and boiler, showing superheater headers and arrangement of piping

also to build up a nice fillet. The boiler was tested to 180 lb. sq. in., slowly built up to allow plates to settle to strongest position, and then again rapidly blown up to 180 lb. sq. in. and left at this for two hours. There were no leaks.

The superheater spearheads were, of course, brazed, as these are really steam bends subject to the full flame temperature.

Fascinating to Watch

Baker's valve-gear was fitted because it is, mechanically, more fascinating to watch, but not, I think, as easy to make as Walschaerts. All gears were case-hardened and holes reamed with silver-steel reamers. Regarding the latter, I find the type filed to a long taper gives the closest fit.

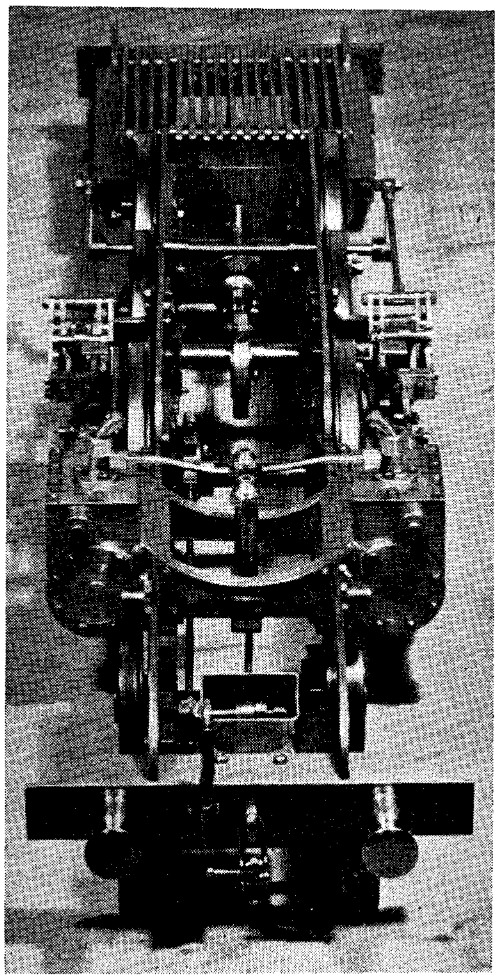
Fluting and milling were done on the vertical slide, using silver-steel end-mills.

Backhead fittings were as "L.B.S.C." except the pressure gauge which was attached to the boiler with a banjo fitting for easy removal. The screwed fitting meant removing the regulator to allow the U-bend to turn.

I endeavoured, without success, to fit ball stop-valves to the water-gauge fittings. I do not like the idea of there being no provision for automatic shut-off should the glass break. If any constructor has managed to fit these to 3½-in. gauge, I would be very interested to know how. On such a small scale the usual ball and cage are, I imagine, not reliable, and introduce a worse danger in possible false levels.

My equipment consists of the usual workshop tools; power emery-wheel, bench driller and that very excellent lathe, the M.L.7.

The photographs, in case some readers are interested, were taken with a Reflex Thornton Pickard, 3½ in. × 2½ in.—P1200 plates—two 100-watt bulbs (one frontal, one side) f32 at 5 ft., 16 sec. exposure.



Front end of chassis, showing arrangement of feed-pump and mechanical lubricator

GEAR CUTTING

With the Shaper

by "Base Circle"

FIRST, let it be said that the method here described is not claimed to be original. All that is claimed is that it does not appear to be generally known to readers of THE MODEL ENGINEER and that the writer has not come across any reference to such a method in print.

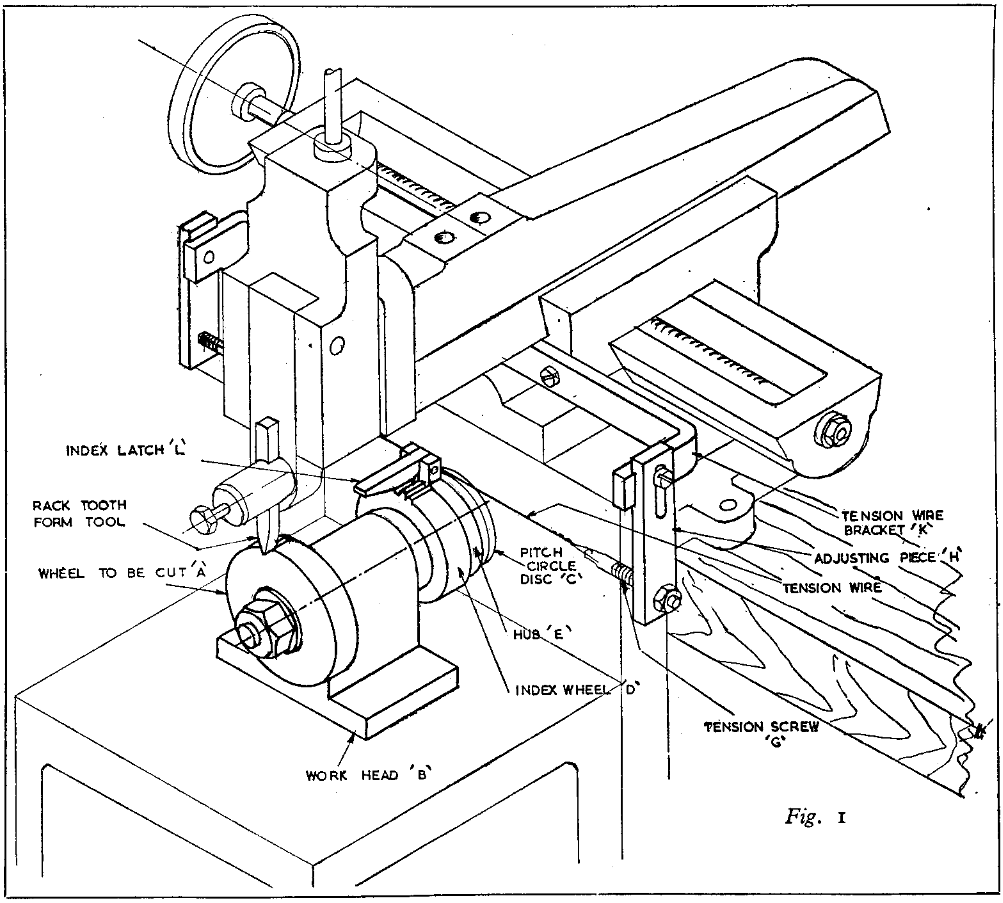


Fig. 1

The idea is to use a shaping machine (in the writer's case, a very old hand-operated machine) and to fit to it a mechanism on the lines of that used in some types of gear-grinding machines, such as the "Maag" or older "Lees-Bradners" to give a rolling motion to the gear blank while being cut. This method, being a true generating method—right back to first principles—results in a correctly formed involute tooth.

The curved sides of the tooth are made up of a series of small flats and the results can be made more and more accurate by reducing the feed of the machine and thus making the flats narrower. In other words, the finer the feed of the machine, the better the result. Even with only a moderately fine feed, however, the results will be very much better than those produced by the milling process with disc cutters. A disc cutter can, of course, only be correct for one diametral pitch and one number of teeth. As a compromise, such cutters are certainly sold to cover a range of teeth, but when so used, the resulting teeth are not correctly formed.

Using the suggested method, the cutter is a straightforward shaper tool, ground to the form of a rack tooth of the diametral pitch to be cut. The sides are straight and inclined to the centre-line at the same angle as the pressure angle of the tooth—*i.e.*, usually $14\frac{1}{2}$ deg. (an included angle of 29 deg.). There is no difficulty

in making such a tool, and if the same tool is used for the two wheels which are to mesh together, there is not even any need for meticulous accuracy in the tool. The cutting edges are backed off in the usual way.

A drawing of such a tool appears in Fig. 2.

This cutter will be suitable for all numbers of teeth of this particular diametral pitch.

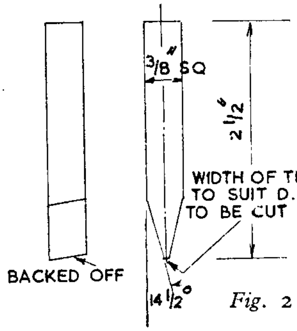


Fig. 2

The principle is fairly clearly shown in the isometric view, Fig. 1, where it will be seen that the wheel to be cut "A" is mounted on a mandrel carried in a bracket "B" bolted to the shaper table. At the other end of the mandrel is mounted a pitch circle disc "C" which is connected to the mandrel through a dividing mechanism. In this case the dividing mechanism is simply constructed round a 120-tooth wheel "D" which was available. (Suitable wheels with 120 teeth can often be got from derelict magnetos). A 120-tooth wheel was chosen because it gives a conveniently large number of divisions, but it can be replaced by other wheels or a properly made dividing plate can be used if available.

A swinging latch "L" pivoted on the hub "E," on which the pitch circle is mounted, is pushed into the tooth spaces of the dividing wheel by spring pressure to give the dividing effect. Of course, more elaborate and possibly more accurate methods could easily be designed and might be worth fitting, but the device shown has given every satisfaction.

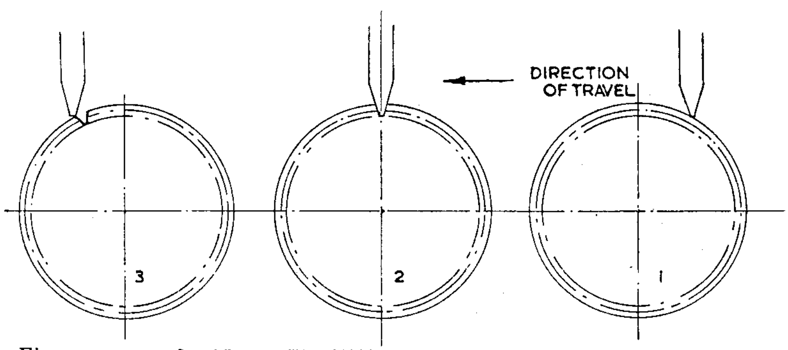


Fig. 3 DIAGRAM TO SHOW CUTTING ACTION

The pitch disc "C," which is made to suit the diametral pitch and the number of teeth in the wheel to be cut, is located on the hub by a dowel and retained by two screws.

Now we come to the generating mechanism. Fastened to the pitch circle disc by a screw, is a length of 18 s.w.g. music wire which winds round the disc and is fastened by the ends through straining screws "G" to the adjustable ends "H" of the bracket "K" fastened to the sliding carriage of the machine.

It will be seen that as the head of the shaper is traversed over the wheel to be cut (see Fig. 3) the wheel will be caused to roll in such a way that the rack tooth-form cutter will produce a true involute tooth. When one tooth space has been cut, the head is brought back to the starting point and the work is set round one tooth by indexing the latch into the correct notch of the dividing wheel "D" (Incidentally, it is well worth while to number every second tooth space in the dividing wheel. It will save time and trouble).

The cutter can, if desired, be set to cut the full depth of the tooth at one traverse of the head, but, for accurate work, it is better to take a roughing cut almost down to the full depth right round the wheel and to follow this with a light finishing cut.

The apparatus as shown is suitable for a hand-operated shaper of the traversing-head type, but can be readily adapted to a power shaper where the table traverses. In this case, the ends of the music wire would be anchored to brackets from the stationary part of the machine.

The principle could also be adapted to cutting gears on the lathe. One could imagine the head carrying the wheel to be cut mounted on the saddle with the operating wire fastened to brackets from the bed of the machine. The tool could be carried in a bar mounted in the four-jaw chuck (this would provide a convenient height adjustment).

The lathe mandrel would be locked and the saddle would be traversed using the rack and pinion or the lead screw. The cross slide would provide the feed, which in this case would have to be put on by hand after every cutting stroke.

It should be noted that the quality of the machine used or its condition does not affect the accuracy of the finished jobs very much. The only machine error which is likely to cause trouble is wear in the traverse feed screw giving rise to excessive back lash. This can be overcome by weighting the slide, by attaching to it a cord which passes over a pulley fixed up in any convenient way, either to the machine or the bench, and carrying a weight of 30 to 40 lb. at the end.

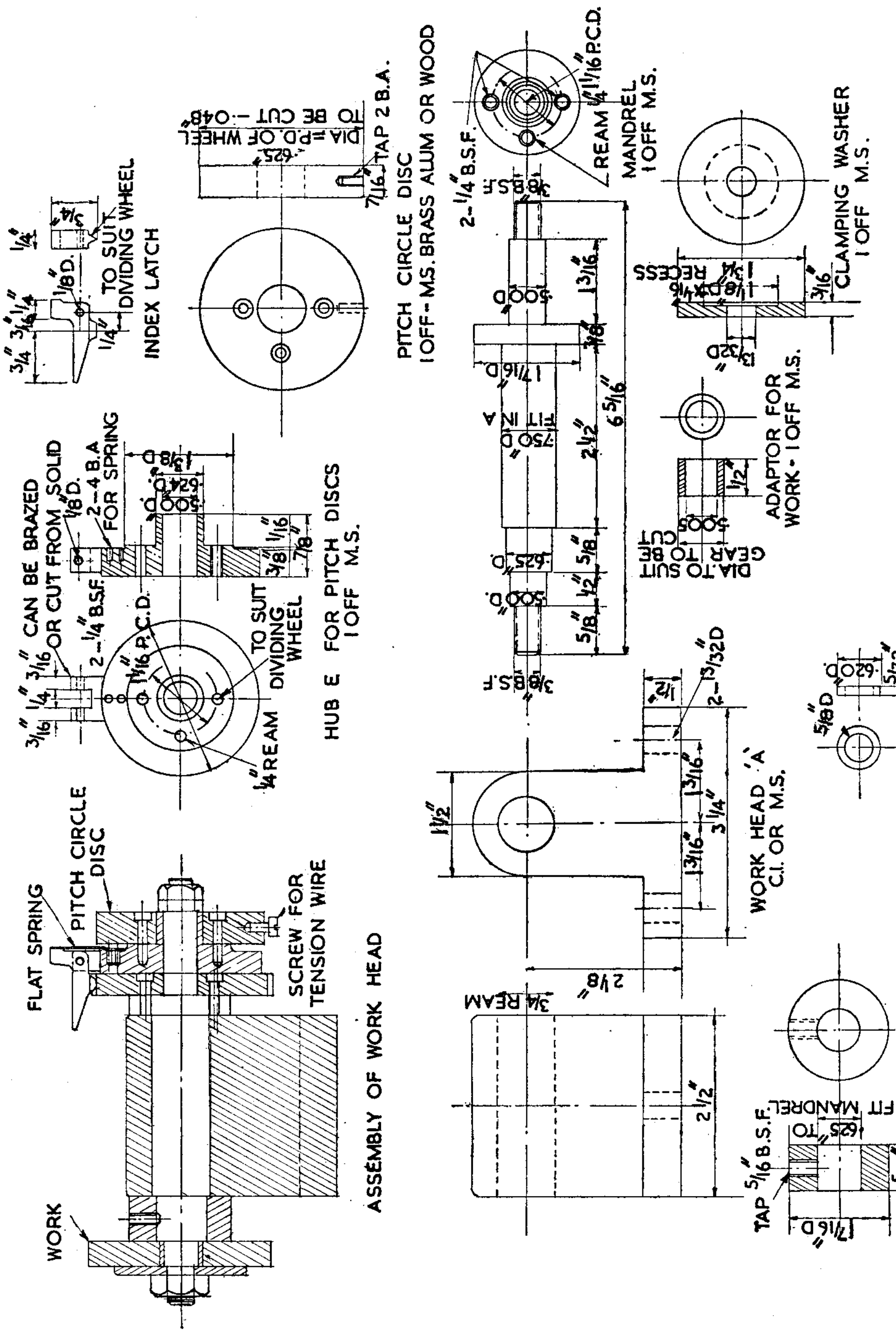


Fig. 4

This will ensure that all slackness is taken up in the same direction all the time.

A few details of the work-head assembly are given in Fig. 4 to show the suggested method of construction, but dimensions and even design would require to be modified to suit the machine to be used, the size of gears to be cut and the method of indexing to be adopted.

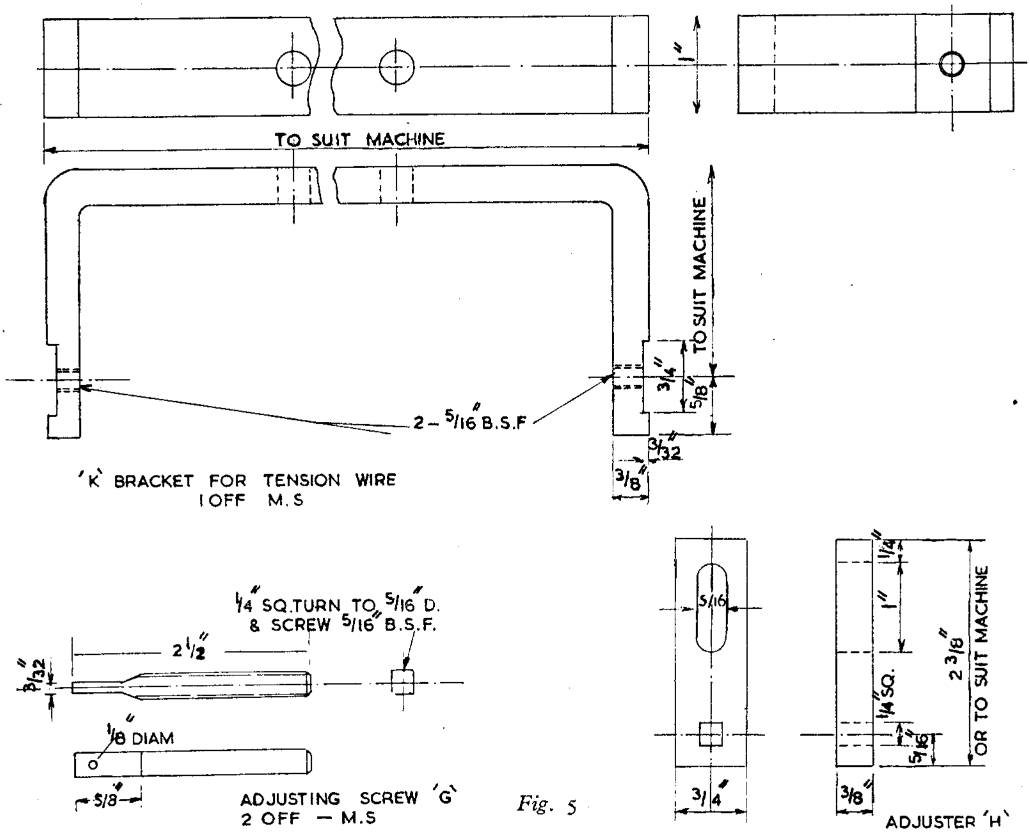


Fig. 5

The work-head "A" may be a casting, cut from solid metal, or may be fabricated by welding. The only important thing about it is the $\frac{3}{4}$-in. reamed hole which should be well finished and parallel to the base.

The mandrel should be accurate in its bearing diameters. It is shown with a flange to which the dividing wheel is fastened by two screws and a dowel pin.

The dividing wheel is not detailed, as it will probably be adapted from some existing wheel.

The hub "E," to carry the pitch circle discs, carries a bracket for the index latch, which again can be cut from the solid or brazed, or welded on. Two tapped holes and a dowel-pin hole are provided for the pitch circle discs.

The index latch will be roughly as shown, but will have to be adapted to suit the index wheel used.

The pitch circle discs are $\frac{7}{16}$ in. thick and can be turned from any material available—mild-steel, brass, aluminium, or even wood. The diameter is got from the formula. Dia. = pitch dia., of wheel to be cut — 0.048 in. (i.e., thickness of tension wire).

A 2-B.A. tapped hole is provided in the disc for fastening the tension wire.

The assembly of hub and pitch circle disc should be free to revolve on the mandrel, except when the index latch is engaged in the index wheel.

The operating wire, when adjusted, should form a straight line tangential to the disc.

In Fig. 5, rough details of the tension wire bracket and adjusters are shown.

The dimensions of bracket "K" will depend on the machine, but the bracket must be rigid enough to allow the wire to be tightened up sufficiently.

The adjusters "H" are held to the bracket by $\frac{5}{16}$-in. B.S.F. screws through a slot which allows for vertical adjustment. Square holes are provided for the tension screws.

The tension-screws are either made from $\frac{1}{4}$-in. sq. mild-steel turned to $\frac{5}{16}$-in. diameter, or from $\frac{5}{16}$ in. diameter material filed to $\frac{1}{4}$-in. square. In either case they are screwed $\frac{5}{16}$-in. B.S.F. They are flattened at the end and provided with a hole $\frac{1}{8}$ in. diameter for the tension wire.

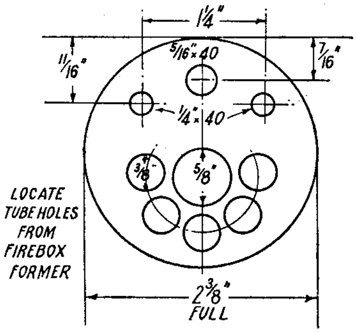
This method of gear-cutting will be found to be reasonably fast; in fact, with a power-driven machine, it will probably be as fast as milling, while the resulting wheels will be much more satisfactory than those usually produced by amateur methods.

It will be found, too, that the process is a very interesting one to watch, and the result in general, will well repay the comparatively slight amount of work involved in the manufacture of the apparatus.

"L.B.S.C.'s" Beginners' Corner

Smokebox Tubeplate for "Tich" Boiler

BEFORE fitting the tubes to the firebox, we shall need the smokebox tubeplate, to act as spacer and support whilst silver-soldering the ends of the tubes into the firebox. A circular forming plate will be needed for this ; anything round, strong, and of the right size can be pressed into service. I have used old wheel castings, chuck backplate castings, an old automobile engine piston, a cast-iron cistern weight,



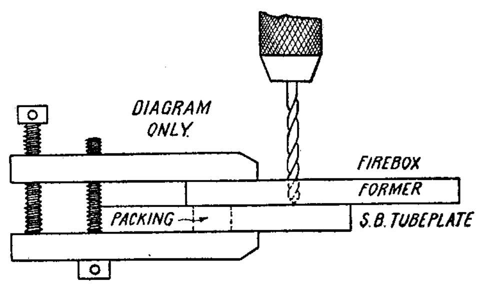
Smokebox tubeplate for smaller boiler

and goodness only knows what else. Most scrap pieces as mentioned above, can be turned to the size required, which is $2\frac{5}{16}$ in. diameter for the smaller boiler, and $2\frac{13}{16}$ in. for the larger one. If you have nothing to suit, cut the disc from a piece of $\frac{1}{4}$-in. iron or steel plate ; rough saw it to shape, drill a hole through the middle, clamp it between two nuts on an old bolt, which you can hold in the three-jaw, or run between centres, just as you fancy (the latter is better for light lathes) and the outside can be turned to the correct diameter with a pointed tool with the point rounded off a little (says Pat) and plenty of top rake. Run the lathe slowly, and use plenty of cutting oil. Speaking of lathe tools, I long since discarded the "regulation" pattern ; have not used a "text-book" tool for over forty years. I always use raked tools, even for soft brass, which is decidedly "against the rules." During my "term of office" at the munition shop during the Kaiser's war, I took full opportunity to find out which shape of tool gave the best results ; and am tickled pink to find out that some of my pet shapes are now used for production work, being independently conceived—"great minds" again ! However, joking aside, it is mighty curious how things pan out. Round off one edge of the former, leaving a good radius.

Cut out a circle of sheet copper, 16-gauge, and $\frac{1}{2}$ in. bigger in diameter than the former. Clamp this in the bench vice alongside the former, radius side against the copper, and beat down the edge of the copper disc on to the edge of the former, same as on previous flanging jobs, taking care that the metal is not allowed to become hard enough to crack. The minute it shows signs of crinkling up, or buckling, re-anneal it. When it lies nicely on the former edge all the way around, clean up the flange with a file, before removing the tubeplate from the former. As I explained before, the file scratches form a "key" for the brazing material. In larger boilers, where the barrel is made from a piece of tube, the flange can be turned to a fairly tight fit, using a round-nose tool and a coarse feed, so that the turned surface shall not be too smooth ; the ragged edge left by the flanging process may also be turned off smooth. This is not necessary in the little boilers for *Tich*, as the barrels are rolled from sheet metal and have a joint in them ; also Inspector Meticulous won't be able to get inside and take a look at the edge of the flange. It if were turned to a millionth part of an inch tolerance, the boiler wouldn't steam one whit the better ; so why worry ?

How to Locate the Tube Holes

There is no need to set out the tube holes in the smokebox tubeplate by any measurement ; simply use the firebox tubeplate former as a jig for drilling the pilot holes. Scribe a line right across the middle of the side opposite to the flange ; and $\frac{3}{8}$ in. from the end of it, make a centre-pop. Lay the firebox tubeplate former on



How to drill tubeplate

the smokebox tubeplate, in such a position that the bottom centre hole is exactly over the centre-pop, and you can see the scribed line passing across the middle of the hole directly above it. Clamp the former to the tubeplate by aid of a toolmakers' cramp, then poke the No. 40 drill through the holes in the former, and carry on right through the copper. Remove former, then open out the holes exactly as given for the firebox tubeplate, using drills and reamers ; but this time, put the reamers well through the holes. If filing to size, either make the holes large enough to allow the tubes to fit easily ;

or better still, open out with a drill the correct size for each tube, $\frac{3}{8}$ in. and $\frac{5}{8}$ in. respectively, if you have no reamers that size. Countersink all the tube holes on the side opposite the flange.

Mark off the holes for stays and steam pipe according to the drawings of the two alternative tubeplates; the larger one has already been illustrated, and the smaller one is shown here. The central hole, for the steam pipe fitting, is drilled 9/32 in. and tapped $\frac{5}{16}$ in. $\times$ 40; the stay holes are drilled 7/32 in. and tapped $\frac{1}{4}$ in. $\times$ 40. See that the taps enter the holes nicely on the square, otherwise the nipples will go in what the kiddies call cockeyed, and the threads will bind.

Tubes

The tubes on both alternative boilers are the same length, viz. $4\frac{1}{4}$ in. Both have one $\frac{5}{8}$ in. $\times$ 20 gauge superheater flue; the larger boiler has nine $\frac{3}{8}$-in. $\times$ 24-gauge smoke tubes, and the smaller five only, same kind. The tubes should be of seamless copper; the larger one is a little thicker, as it forms a substantial stay between the firebox and smokebox tubeplates. The small tubes should always be as thin as possible, consistent with adequate strength. We might use thinner still; the tubes in the original boiler of my old engine *Ayesha* were only 26-gauge, and were salvaged from a bus radiator that had come off second-best in a little argument with a street tramway-car. They lasted the life of the boiler. The only wasp in the jampot is that an inexperienced coppersmith is liable to burn up tubes as thin as 26-gauge when silver-soldering them into the firebox.

Always use a hacksaw blade with very fine teeth, when cutting thin tubes, and saw straight across, leaving them a little longer than finished length. Chuck each in three-jaw, skim the ends off square, with a roundnose tool set crosswise in the rest, and apply a bit of coarse emery-cloth or other abrasive, so as to clean the ends with a scratchy surface. Don't be offended if I remind beginners not to forget to spread a piece of paper over the lathe bed, every time emery-cloth is used. The lathe will last ever so much longer, and the slides won't need adjusting for many moons. The price things are now, it behoves everybody to take care of what they have; I can assure you that I practice what I preach!

When any beginner has a big nest of tubes to silver-solder into a firebox, the best way is to do the job by instalments, say two rows at a time; but in the case of the present boilers, the whole nest can be done at one fell swoop. The set on the smaller boiler is fully exposed; only the two below the superheater flue, are covered up in the larger boiler, and these can be seen between the outer tubes, so will be able to receive their share of the heat. Put all the tubes in place in the holes in the firebox tubeplate, letting them project into the firebox for about 1/32 in. Then put the smokebox tubeplate on the other end; if you put it on with the countersunk side of the tube holes first, it will go on easily. Let it go down over the tubes about $\frac{1}{8}$ in. or so, it will "stay put" by the friction alone. Now very carefully line up the nest of tubes, so that they are parallel with the sides of the firebox, and also with the crown sheet; the whole lot can be adjusted bodily by moving the smokebox tubeplate.

How to Silver-solder the Tubes

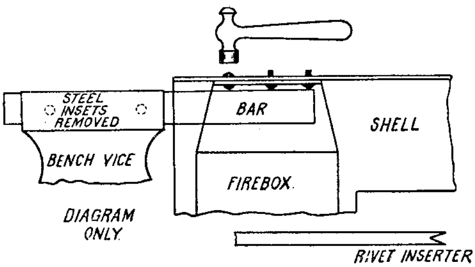
Stand the assembly in the brazing-pan with the tubes pointing skyward. Pile up coke or breeze all around the firebox, to tubeplate level, and fill the firebox to within about $\frac{1}{2}$ in. of the tubeplate. The mixture of flux and water for this job should be fairly thin; put plenty on, so that the whole of the tubes are well covered where they enter the tubeplate. The silver-solder should be of best grade, either No. 1, or "Easyflo" (I use the latter) and is handiest if used in a long thin strip about $\frac{1}{8}$ in. or so in width. Get your blowlamp going good and strong, and carefully heat up the firebox first, blowing all around the outside, and partly inside; keep the flame off the tubes as much as possible. This is where you have to watch your step; it is easy to have a disaster, but at the same time it is just as easy to achieve complete success, which only needs what is popularly known as "common savvy" plus a little patience and care. When the coke is glowing red, and the firebox is well heated, play a little on the tubes; and as soon as a tube glows red, with that portion of the tubeplate in which it is fixed, apply the strip of silver-solder to it. The end will melt off and flash clean around the joint; "Easyflo" is very hot (in more senses than one!) at this game. The silver-solder will not only form a fillet, but penetrate clean through, showing as a silver ring on the inside of the firebox. Give each tube a dose of the same physic; you will find that you can get at the two inner tubes on the larger boiler, through the spaces between those in the bottom row. Give the big flue a bit extra for luck. Let cool to black, and whilst this is taking place, pull the smokebox tubeplate off the outer ends of the tubes, which is easily done with a pair of tongs, holding the firebox down with a piece of rod. Apply the blowlamp flame to the ends of the tubes until they are red-hot, so as to soften them all ready for expanding into the smokebox tubeplate when assembling the boiler. Then put the whole lot in the pickle for 15 min. or so, afterwards well washing in running water (kitchen sink is the best place for this job) and cleaning up.

Tip: silver-solder only requires a medium heat to run perfectly; if the heat is too great, it bubbles and becomes porous. I never use my oxy-acetylene outfit for silver-soldering tubes of the kind described above. All you need, is enough heat to make the silver-solder run freely; no more.

First Stage of Assembly

We now have the shell, and the firebox and tubes, made up as two units, so the next stage of the proceedings is to assemble them into one. First we shall need the front section of the foundation ring, which isn't a ring at all (says Pat) either on this engine or its full-sized counterpart. On the latter it would, however, be all in one piece, with rounded ends; for our purpose it is easier to make and fit it in four separate pieces, which are virtually made continuous by the final brazing or silver-soldering

job. A piece of $\frac{1}{4}$ in. square soft-copper rod is needed for the front section, which is first to be fitted; this should be just long enough to jam tightly between the bottom edges of the throatplate flange. Round off the corners at each end, where they fit into the flange, so that full-length contact is made with the throatplate bottom. Clean up the copper well, also bottom



How to rivet crownstays

of throatplate, and slightly bevel the sides of the piece of rod, as shown by the black triangles in the illustrations showing the sections of the boiler. This is to allow the brazing material plenty of room to penetrate. Boilers brazed with ordinary spelter, or bronze-welded, require more grooving than those which are silver-soldered only; this applies also to any joint as well as boilers.

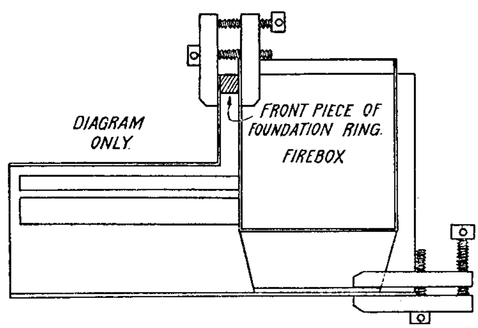
Clean all the parts which will come into contact; then insert the firebox and tube assembly into the shell, as shown in the illustration. The firebox tubeplate should butt up tightly against the piece of foundation ring, nicely in the centre of same, and the top crownstay flanges should be in close contact with the arch of the wrapper sheet for their full length. If they aren't, a little judicious bending is called for. When all O.K. put a toolmakers' cramp over the throatplate, piece of foundation ring, and firebox tubeplate, and another over the wrapper and one of the crownstay flanges. Drill a No. 51 hole clean through bottom of throatplate, foundation ring, and firebox tubeplate, at each side of the cramp; put in a couple of $\frac{1}{16}$-in. copper rivets, and rivet over. You needn't bother about fancy heads; in fact, a bit of copper wire would do, well headed over at each end. These rivets are neither for strength nor show; merely to hold the parts together whilst the brazing job is in progress. They can be filed flush afterwards, if you care to take the trouble.

Now drill three No. 51 holes through the wrapper sheet, and the crownstay flange that isn't held by the cramp, and put three short $\frac{1}{16}$-in. copper rivets in, to hold the flange to the wrapper whilst silver-soldering. To hold these up whilst being riveted over, put a short piece of iron bar in the bench vice, with about 3 in. projecting from one side; this makes a fine dolly. To prevent it slipping down whilst you perform with the hammer, take out the inset steel jaws of the vice, usually held by two screws apiece, and rest the bar on the ledges which support the insets. To put the rivets through the holes from the inside of the wrapper, use a strip of tin about $\frac{1}{4}$ in. wide, with a notch in the end like a distant signal. Jam the rivet in the notch, insert it in the hole, and pull away the strip. When beating down the projecting stem of the rivet, aim carefully and hit the rivet, not the boiler shell; it doesn't have to look as though it had been on an expedition to Korea. Again, no fancy heads are needed, as they are filed flush with the curve of the wrapper when the job has been silver-soldered. After doing one flange, take off the cramp, and ditto repeato operations on the other flange. If the job has been properly done, the firebox and tube assembly should now be a tight fit in the shell, the joints of throatplate, crownstay flanges and wrapper all being close, with no gaps.

How to Fit Smokebox Tubeplate

Another job, easy, but requiring care. Insert the tubeplate, flange first, taking care it is up quite straight; a line drawn through the centres of top and bottom holes, should be vertical. Gently tap it down until it almost touches the tubes, and then line up each tube with its respective hole, by aid of a wooden knitting needle, wooden meat skewer, or a blacklead pencil. They will adjust quite easily, being softened by the silver-soldering; but be mighty careful not to distort the end at which you are prodding! When all are lined up, tap down the tubeplate evenly all around, until the tubes are standing about 1/32 in. proud of the tubeplate; the edge of this should be the same distance from the end of the barrel, all the way around. The exact distance doesn't matter a bean as long as it is constant.

The next job is to expand the tube ends. This is done with a taper drift, as in full-size practice



How to assemble firebox and shell

when roller expanders are not used. The drift is a tapered steel plug; if you have a drill shank, or something similar which will fit the tube ends, it will save the trouble of making a special drift. Otherwise, take a piece of steel a little bigger than the outside diameter of the tubes, and turn a slight taper on it (exact angle doesn't matter; the angle of a drill-shank will do) so that it goes into the tube about $\frac{1}{2}$ in. Polish well with fine emery-cloth; the smoother the drift, the easier it will come out. Grease it, and insert into the tube; give it a sharp crack or two with

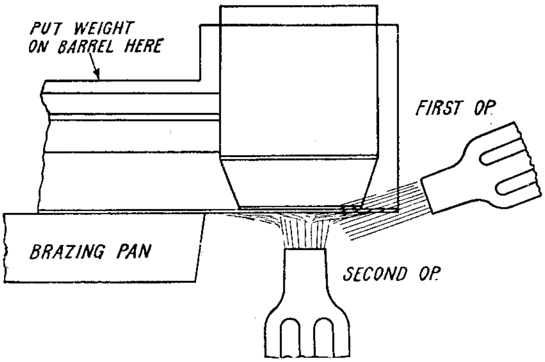
a hammer. This will expand the tube end, bringing it closely into contact with the hole. If the drift doesn't want to come out, a sideways tap will usually teach it good manners; but if expecially obstinate, you can prod it out with a rod from the firebox end, though this is very seldom needed. A polished greased drift should fall out, of its own free will and accord.

More Perspiration

The next job is to braze in the smokebox tubeplate, silver-solder the tube ends, and silver-solder the crown-stay flanges to the wrapper sheet. After beginners' two previous essays at the perspiration job, this one should be quite easy, as you will be getting quite skilful with a blowlamp by this time. To save heating up the whole issue to the melting point of the brazing material, proceed as follows. Get a tin lid, or small tray or other receptacle, any shape will do. Cut a hole in the middle of it, big enough to poke the boiler barrel through. Up-end the boiler in the brazing pan; it might be as well to cover all joints with wet flux before doing this, as the heat travelling down from the smokebox end, will dry out the moisture from the flux along the crownstay flanges, and make the job quicker. Put plenty around the edge of smokebox tubeplate, and around the tube ends. Put the "holey" lid or tray over the end, and prop it up each side with something fireproof, so that the end of the barrel is about 2 in. above the tray; then pile up coke or breeze on it, level with the top. Plug all the tube ends with bits of asbestos string or flock, so that the flame doesn't go down inside and burn them just below the tubeplate.

Get the blowlamp going again, and heat up the coke all around the end of the barrel until the whole lot glows red; then concentrate on one point in the circumferential joint—or as Bert Smiff would say: "Ennywhere rahnd the edge'll do"—and keep at it till that glows red too; then apply your stick of easy-running strip, and proceed step by step, same as you did the other joints, until the circuit is completed and you are back where you started. Give that point an extra blow-up, to make certain the brazing metal thoroughly runs into a perfect ring, with no break in it. If you like, a coarse-grade silver-solder, such as Johnson-Matthey's B6, can be used for this job, with the special flux sold with it (Tenacity No. 1); or ordinary No. 3 grade, with borax as flux.

By this time, the flux around the tube ends will have fused and glazed; so play the blowlamp flame direct on the tube ends, and touch each with a strip of best grade silver-solder, or "Easyflo." This will run exactly as it did around the firebox end of the tubes. Now you come to the part where, as the conjurer says: "the quickness of the hand deceives the eye." With the big tongs, pull the "holey" tray or lid off the barrel, and put it aside out of the way; lay the boiler on its back quickly in the pan, with the firebox end overhanging. Put something heavy (a firebrick will do) on the barrel to stop it from tipping up. Now cut off two strips of silver-solder a little over $1\frac{1}{2}$ in. long, dip them in the wet flux, and lay them along the outside of the crownstay flanges; the home-made tongs come in handy here. Blow partly outside and partly inside, till the lot becomes red, and the silver-solder starts to melt; then give the lamp an extra pump up, and blow on the underside, on to what is really the top of the wrapper. Keep it up till the whole issue is bright red, the silver-solder all melted, and sweated right through the joints at each side. Let cool to black, and be very careful how you put the boiler in the pickle, as it is now getting heavy, and there is plenty of metal to quench, with corresponding increase in the liability to splash. Leave it about 15 minutes or so as before, then fish it out, wash well, and clean up. There should be a clean silvery ring around both ends of each tube, if the job has been properly done. Next stage, final assembly; this will entail the biggest brazing job of the lot, but there isn't the least need to be scared of it, as by now, any beginner with the average amount of gumption, can tackle it with confidence and be assured of success.



How to silver-solder crown-stay flanges

Catalogue Received

A copy of a second edition of the catalogue issued by Messrs. A. J. Reeves, of Birmingham, reached us recently, numbered 1950/2, and is more fully illustrated than the previous one. Some of the lists of castings, parts and materials for nearly all "L.B.S.C.'s" locomotives have been extended and brought right up to date, while the range of small tools and workshop equipment has been augmented. The catalogue will be sent to any address, upon receipt of 6d. in stamps, from A. J. Reeves & Co. Ltd., 416, Moseley Road, Birmingham, 12.

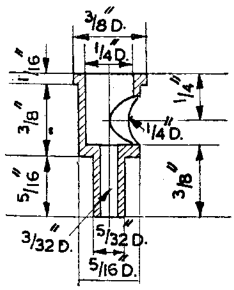
PETROL ENGINE TOPICS

*A 10 c.c. Twin Four-Stroke

by Edgar T. Westbury

APOLOGIES are due to readers for the omission of the detail drawing of the valve liner, which was described on page 330 of the August 31st issue. This drawing is reproduced herewith, and calls for no further comment than that contained in the description, other than the somewhat obvious note that two of these liners are fitted to each of the cylinders, the inlet and exhaust liners being of identical dimensions.

After the cylinder and valve liners are inserted, the top face of the cylinder barrel can be machined to final dimensions, bringing the rims of the liners flush with the surrounding surface. A light lapping on a piece of plate glass should then be sufficient to secure a close limit of flatness all over. When drilling the holes in the cylinder barrel, head and cover plate to take the securing studs, a check-up should be made to ensure that these holes pass through solid metal, and do not break into either the combustion head or water space.



VALVE LINER 4 OFF C.I.

For drilling the holes in the cylinder base and top surface of crankcase, it is desirable to make a template or jig from steel plate about $\frac{1}{8}$ in. thick to ensure their correct location, as it is difficult to be sure of this by working to marking out by the usual methods, and " spotting " from the cylinder flange to the crankcase is impracticable. The plate should be bored to fit exactly over the projecting end of the cylinder liner, and finished to a true rectangle on the outside, to the dimensions of the cylinder base flange, after which the holes are carefully marked out and drilled to tapping size ; it should also be clearly marked to identify top and bottom faces, and front and rear edges. This can be applied directly to each of the cylinder bases, and held in place by a light clamp or hand vice while using it as a drill jig. It is then located, in an inverted position, on the top of the crankcase, using a close-fitting plug in each of the cylinder seating bores, and squaring up the side edges of the plate to the machined end faces of the casting. This will positively ensure that when the studs are fitted, and the holes in the cylinder flanges opened out to clearance size, the cylinders will drop into place without the necessity of " drawing " the holes. It is, however, desirable to allow clearances on the liberal side, to enable the side faces of the valve ports to be correctly aligned, but the spigots of the cylinder liners should always fit snugly in their seatings.

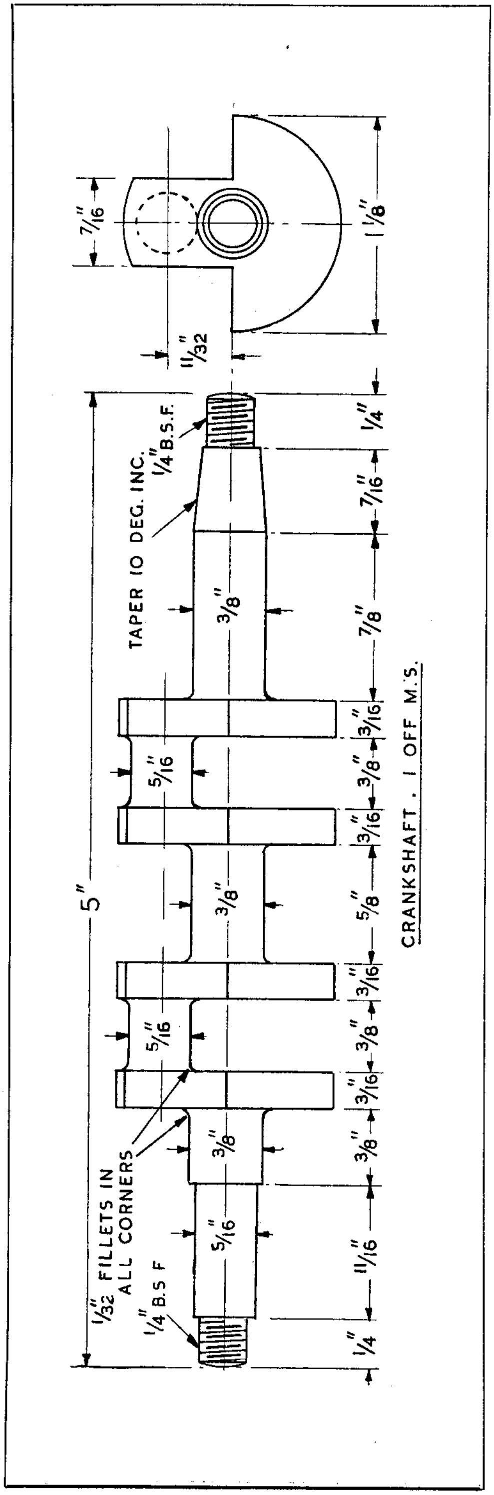
Crankshaft

As in most other types of engines, the crankshaft is the biggest single machining job, and whatever method of machining or fabrication is employed, it calls for considerable care and cannot be hurried. I have described several different methods of making crankshafts in the past, and with the exception of those applicable only to overhung cranks, any of them could be used here. For rigidity and positive accuracy, the method recommended for the " Ladybird " $2\frac{1}{2}$ c.c. twin wants a lot of beating, but the objection to its use on larger sizes of engines is that the split clamp fixture used for eccentric chucking would have to be of proportional size. If this method is employed, however, a slight modification in procedure should be noted : namely, that the two crankpins must be located in the same plane, instead of opposed at 180 deg., as in the " Ladybird" engine.

The proportions of this crankshaft, however, are sufficiently sturdy to enable it to be machined by the " orthodox " method, between centres, and I find that many model engineers prefer this method, apparently obtaining quite a lot of satisfaction from the task of removing metal by easy stages from a huge chunk of round steel bar. It is, however, recommended in this case, on account of the length of the end journals of the shaft, that these should be left well on the large side, or even practically to the full web diameter, until after the turning of the centre journal and the two crankpins ; it is then practicable to rig a fixed steady on the centre journal to improve rigidity during the operation of finishing the end journals.

The method of marking out a round bar for turning a crankshaft has been described on several occasions, but for the benefit of newcomers who may be in some doubt about this, the procedure is as follows : Select a dead straight piece of bar, of sufficiently large diameter to enable the outside of the webs to be cleaned up, and cut it to length, with allowance for facing ; square up the ends roughly, either by filing or machining according to facilities. Set the bar on a pair of parallel vee-blocks, on the surface plate or other truly flat surface, and

*Continued from page 333, " M.E.," August 31, 1950.



find the centre by using the scribing block (or surface gauge), adjusting the height of the scriber point as required until lines scribed tentatively on the end of the bar, at any point in its rotation, intersect at the same point, which represents the true geometrical centre.

At this point it is advisable to remove the bar from the vee-blocks, and obliterate the trial marks to avoid risk of subsequent confusion, but avoid shifting the scriber adjustment. The bar is now replaced and a clear centre line drawn on each end face, also produced along the full length on each side ; it must obviously not be allowed to move during this operation. To ensure clear lines, quick drying marking colour or other suitable surface coating is a great help ; and a sharp scriber is also essential, as blurred or vague lines are fatal to accuracy. Next turn the bar at right angles, sighting the centre line already made against a square laid on the surface plate, and scribe another centre line all round, as before.

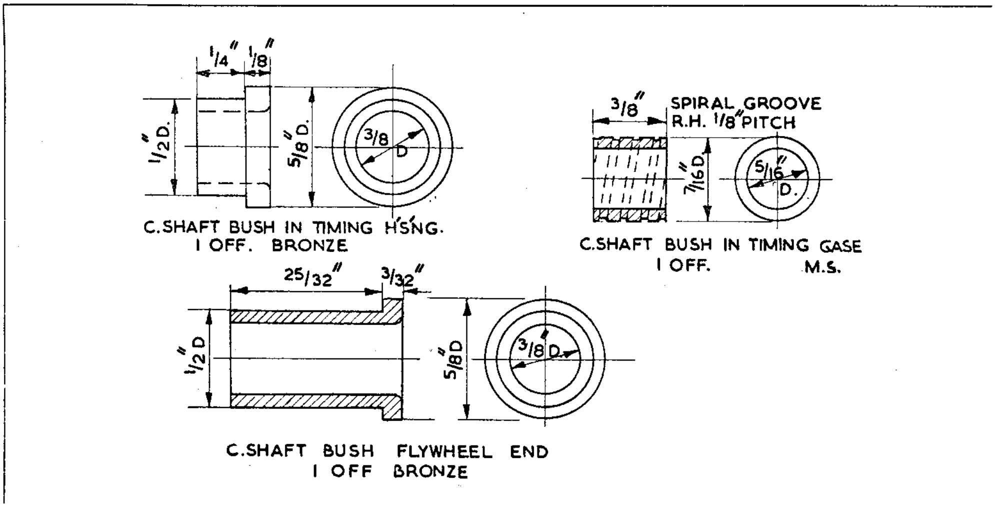
The exact height of the scriber point should be checked by means of a rule or height gauge, and the scriber then shifted either up or down, to the extent of the crank throw—in this case 11/32 in. At this setting, a cross line is scribed to intersect the vertical centre line on each end face of the bar. All four intersection points are then carefully centre-punched to indicate the main journal and crankpin centres respectively. It is then desirable, though not absolutely essential, to mark out the width of the crank webs from the crankpin centre, and use the scribing block, as before, to produce lines along the full length of the bar. The lateral positions of the webs may also be measured off, and marks made on the outside of the bar, to be produced all round with a point tool when machining is started. To form the working centres on the ends of the bar, a small centre-drill should be used, either in the lathe or drilling machine, and great care exercised to see that it does not wander off the intersection point ; it should be entered deeply to form an adequate countersink to provide a good bearing for the lathe centres.

During the machining operations, it is desirable to retain the scribed marks as long as possible, so the outside of the webs, and the end faces of the bar, should not be touched until it is necessary to do so. It is possible to remove a lot of the unwanted metal around the crankpins by drilling and hacksawing, but care must be taken to leave ample machining allowances on all parts. The webs could be cut away at the sides at an early stage of the proceedings, but most constructors prefer to do this after the bulk of machining has been carried out.

A fairly long turning tool, similar to a parting tool, but with rounded corners, will be necessary to reach the crankpins between the insides of the webs. Do not forget to leave liberal fillets in all corners of crankpins and journals to promote maximum strength. After the crankpins are finished, and before finishing the main journals, pieces of metal should be made to fit closely, but not tightly, between the webs, and secured by wiring to the crankpin, or tacked with solder, to stiffen the shaft for final turning. All the tools for crankshaft turning should be keen,

with plenty of top rake, and definite but not excessive side clearance. Patience is not only a virtue, but a sheer necessity, in this work, and the ability of a lathe to remove metal at heavy production rates is no advantage whatever, as the limiting factor is the deflection strength of the work itself.

Rechuck in the four-jaw chuck, setting up so that the line of division is exactly central; bore out with a keen boring tool to finished size, also face the end and machine externally to finished dimensions. The width between the flanges of the bearing should be adjusted to a close fit over the sides of the bearing cap in the crankcase.



Crankshaft Bearings

Plain bearings are specified for use in this engine, though it would be quite practicable to fit ball races on the end journals, as in the "Seal" four-cylinder engine. I cannot, however, see any positive advantage in doing so in this particular case; the bearing surfaces are quite adequate for the kind of duty for which the engine is designed, and even if it should be "hotted up" for higher speed and performance, they will stand up well so long as they get proper lubrication.

The end bearings are plain bushes and present no special machining problems; they may be turned all over at one setting from bronze bar, and parted off. Do not forget to chamfer or radius the mouth of each bush to clear the crankshaft journal fillet. The outside should be a good interference fit in the bore of the housing (about 0.001 in oversize), and the bore finished by means of a reamer or fine boring tool, preferably a little on the tight side for final finishing *in situ*.

A split bearing is necessary for the centre journal, and this calls for a little more trouble, though it is not really difficult. Take a piece of bronze stick long enough for the bearing, plus an ample chucking piece, face the end, clean up the outside well oversize and drill an undersize hole through the centre. Mark a centre line along each side for the full length, and split the piece on this line with a hacksaw or slotting saw. Next face the cut surfaces either by filing or machining, so that they fit together perfectly (test them on the surface plate, as good contact is most important) and temporarily sweat the halves together with soft solder. Finally part the bearing off to correct length, allowing a skim for subsequent facing to fit between the crank webs, and radius each end of the bore to clear the journal fillets.

Some of my readers who were rather critical of my decision to use only two bearings for the crankshaft of the "Seal" four-cylinder engine, have asked me why I have considered it necessary to introduce a centre bearing in this engine, which has only two cylinders, implying thereby a lack of consistency in my methods of design. The operative word, however, should not be "necessary" but "appropriate." In the "Seal" engine, which is based on automobile practice, every effort was made to keep the engine as short and stiff as possible, using monobloc construction to enable the cylinders to be spaced as closely as possible; in such a case, the addition of a centre bearing large enough to be of real use would have largely defeated this object. The "Seagull" engine, however, with its separate cylinders, represents a type of engine almost exclusively employed for marine duty, which is continuous "collar work" involving heavy slogging at relatively low speed. Such engines, in full-size practice, invariably have a main bearing between each of the crank throws, however many cylinders are employed.

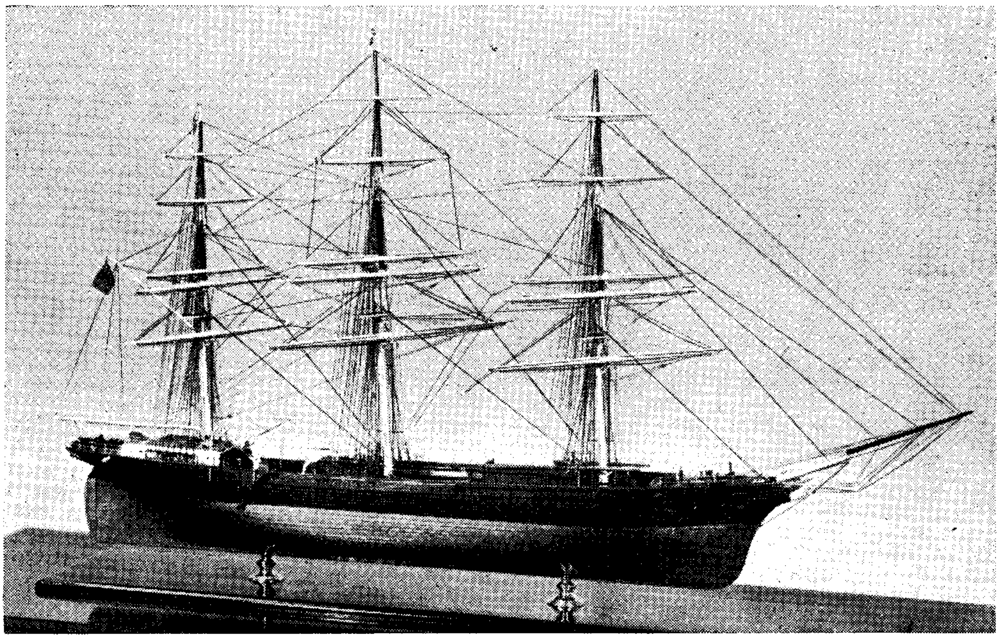
The steel sleeve on the timing end of the crankshaft, which is illustrated in the same detail drawing as the bearing bushes, serves the dual purpose of a distance bush, to enable the timing pinion to be clamped endwise by the crankshaft nut, and a seal to prevent escape of oil from the timing case. It is not intended as a bearing, and in view of the difficulty of providing a

(*Continued on page* 415)

Ship Models
at the "M.E." Exhibition
by "Jason"

THIS year's Exhibition does not provide many surprises except, perhaps, that the standard is higher as a general level and the numbers are somewhat down on last year. Though the standard is higher, there are very few outstanding models, and perhaps, we may look for the few in the sailing-ship section. I am writing this while still in the throes of the first day, and consequently, am unable to give a detailed criticism and, of course, I can give no indication as to awards.

Among the steamers, there is a plentiful supply and of a reasonably good standard, as one might expect from such names as Taylor from Gosport, Fletcher from Colne, Miller from West Drayton, Shelton from Dunstable and a new-comer, whom I must mention, Dr. Machanik, from Liverpool, (and, incidentally, a South African—Jo'burg.). I noticed in Shelton's model, a tramp-steamer, his attempt at getting the somewhat work-a-day appearance and this made me wonder if there should be some sort of scale idea in striving for that particular finish. He certainly is successful in avoiding the highly glazed finish which would have killed the tramp-steamer atmosphere. Among the steamers I noticed, three examples of canal barges by W. Nutt of Laindon. These are very well made and show fidelity. Mr. Nutt knows his stuff! An interesting exhibit was a group model by the Purley County Grammar School, M.E. Society, of the Dutch Tug *Zwarte Zee*. This looks a very fine job although up to the time of writing, I have not had an opportunity of closely inspecting any of the work. One of the most beautiful looking models among the steamers is that of the steam yacht *Iolaire*. Nevertheless, I like Mr. Fletcher's cup-winning entry of last year, better than his *Iolaire*. The working model of the Liverpool class R.N.L.I. lifeboat, by Bays of Sheffield, caught my eye. This is a radio-controlled job, and it is nice to see some of the more unusual types catching the eye for the craftsmanship. Another such example was an old-type first-war picket-boat by Woodruff of Dunstable. This particular model reminded me of a very fine picket-boat exhibited in pre-war days by an Edinburgh man. Dr. Machanik's steam tug is, I think, well into the Medal class, for its excellent finish, accessibility, efficient lay-out and fidelity to detail.

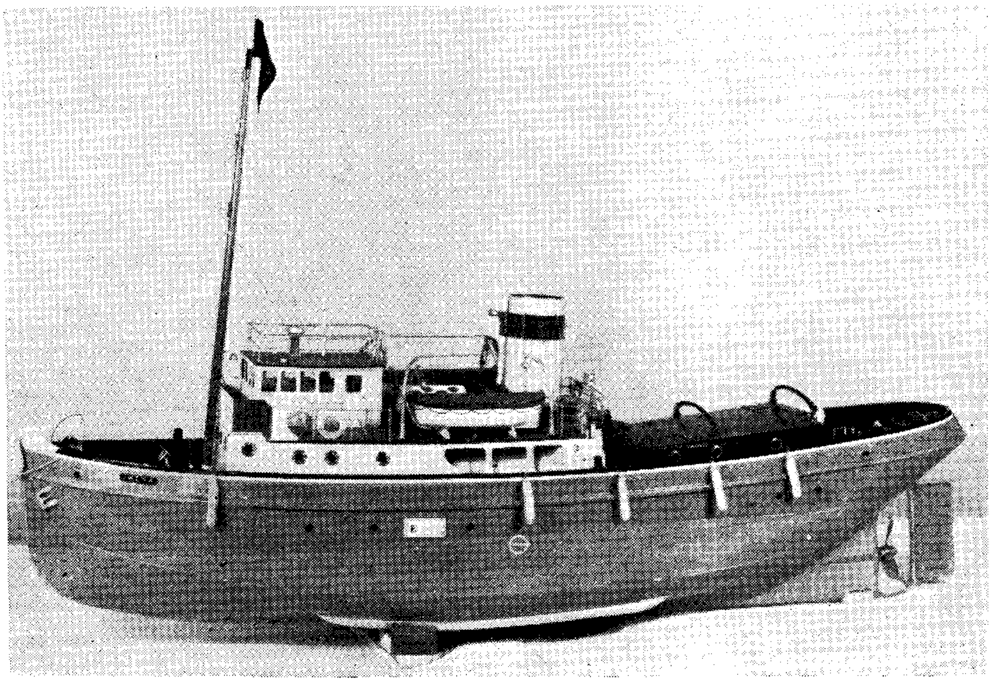


"Thermopylae," awarded the "Championship Cup" in the sailing ship section. Over 2,000 separate sheets of copper were pinned to her hull. Model by I. W. Marsh (Barry Dock), who has been a medallist in the sailing ship section on several previous occasions

In the sailing ships, we have a similar situation

to that which happened last year in the steamers ; a quartette of serious contenders for top honours. Admiral Blackman has a rigged model of the first-rate *Prince* of 1670. Generally, there are one or two *Princes* every year. But this one is a thoroughly craftsmanlike job and shows ample traces of careful research work on the part of the maker. His blocks and rigging are, like his timbered and planked hull, of first-class workmanship. Most modellers will remember that the *Prince* had a lot of carving on the stern, the quarter galleries and the wreath-ports. It will be obvious that some scales are better-suited to carving than other scales. And this even varies with the skill of the carver. Add to this a coating of gold leaf or paint and I would think that the result falls short of the carver's expectations if he has not chosen a scale suitable to his capacity. In this case the modeller is quite at home in his scale.

Neck and neck with Admiral Blackman is Marsh, of Barry Dock, with his model of the clipper ship *Thermopylae*. This also is a timbered and planked model and what Marsh loses by lack of sails is amply made up by his marvellous metal-work in miniature. For example, he has davits on his boats to a scale of $\frac{1}{8}$ in. to 1 ft., say about $1\frac{1}{2}$ in. in height. At the davit head, he has the butterfly separate from the block-head and all of them working parts. His anchors at the same scale are also made up of five working parts, while his steering gear, open for all to see, has the right- and left-handed worm screws attached and working in conjunction with the wheel and the rudder, which, in itself, is a marvellous piece of work. Any errors there may be in these two models are of such minor proportions that it would be difficult to make anything of them in relation to the excellent high standard of the models in general. The copper sheathing on Marsh's model is, in itself, a marvellous piece of work, each sheet being correctly scaled, pinned and shaped to the hull in an amazingly fine finish. Perhaps not quite up to the standard of these two leaders come two others—the American Brig *Pilgrim* of 1834 by Clarke, of West Bromwich. His craftsmanship is equal to either of the others and he will only fall astern, if he does, by reason of the quantity of work involved. Using racing parlance, the *Victory*, by Pariser, of Birmingham, comes from a same stable as the Brig *Pilgrim*, and this model will certainly be close astern of the other two. His copper-plating and general rigging work is of a very high standard and it has already swept the board at other exhibitions. Well, the choice of the winner from these four is the judges' headache and has no concern with this article.



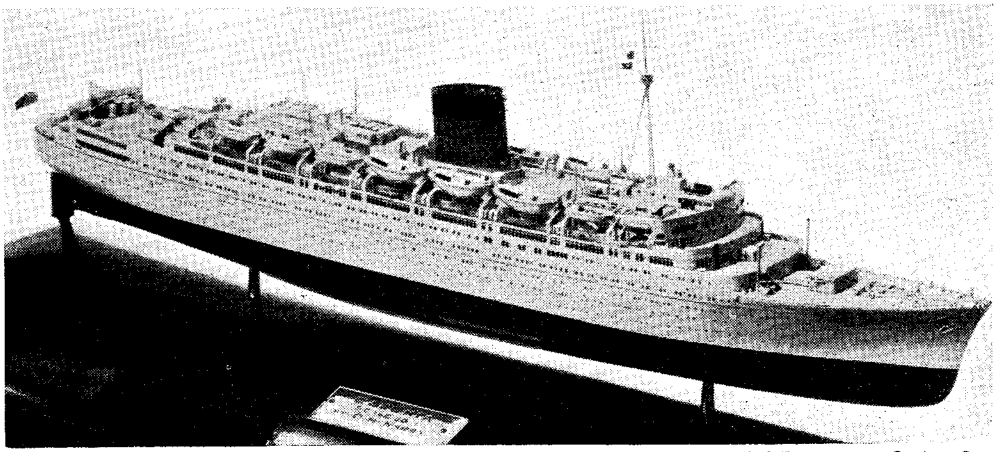
Winner of the special " Wellingham Cup." The Mersey tugboat " Irena " was the runner-up in the power boat section and was closely behind the champion. The 30 in. " Irena " by Dr. Machanik (of Johannesburg and Liverpool) was noteworthy by perfection in accessibility, a thoroughly efficient layout of a very satisfying steam power unit

I think mention should be made of the high standard and choice of subject displayed in the sailing ship section particularly. Consider such examples from the catalogue as the *Adler Von Lubeck, circa* 1600, and Egyptian sailing ship of

the 18th dynasty (the famous expedition to Punt), a Harwich bawley, a Morecambe Bay prawner, the *Flying Dutchman*, with full ghostly effects, by the irrepressible Money, of Sheffield, a naval despatch schooner of the late 18th century, and some others equally interesting.

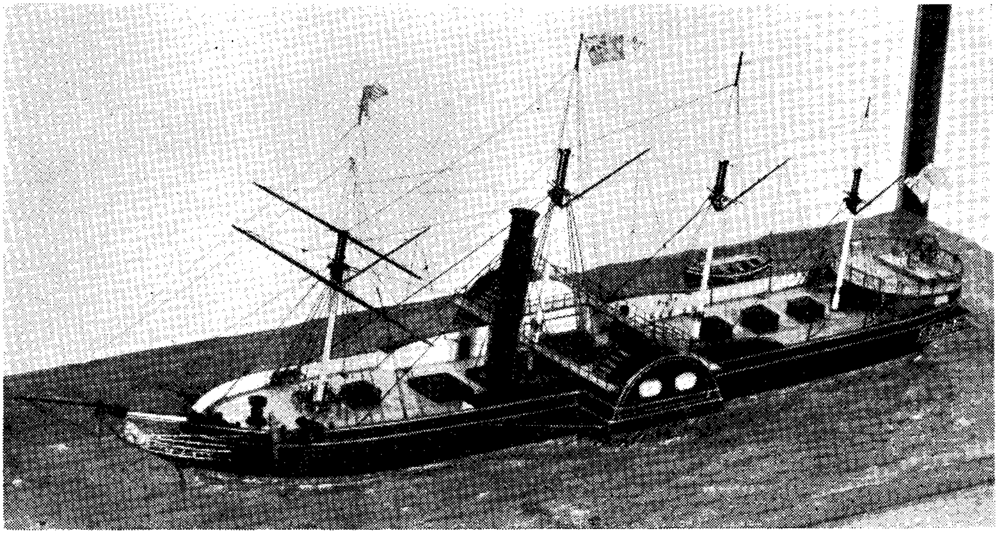
I was very disappointed in the section for working models of sailing ships. But there was some compensation in the loan model *Cutty Sark*, which was on view. This was greatly admired by many people not because it was a *Cutty Sark* in the Longridge style but a *Cutty Sark* that, when on the water, looked like the *Cutty Sark* when she was afloat and under sail. There was a fair entry in the hydroplanes and speed boats but nothing really outstanding for this class.

And now we come to the miniatures, which, as usual, is, and has been for some years, the backbone of a ships' section so far as numbers are concerned. It is in this class that competition is fiercest. Such old-established names as Carpenter, of Brighton, Lewis, of Birkenhead, Kirby, of Mitcham, Beck, of West Wickham, Anthes, of Sheffield, who seems to be equally at home in miniature and medium-scale stuff, Mr. and Mrs. McNarry, of Barton-on-Sea, Bowen, of London, E.12, and Moon, of Holloway, are at once a guarantee of quality. Let us look at some of the exhibits in this section. They have variety, undoubted craftsmanship, colour, and some of them even have moods. One thing I want to deal with first and that is the work of a woman, Mrs. McNarry, of Barton-on-Sea, whose husband has already been mentioned. Her exhibit is the Paddle Steamer *Great Western*, of 1837. And she works to the unusual scale of 1 in. to 28 ft., which reminds me that, on a former occasion, she won a Bronze Medal, using a scale of 1 in. to 14 ft. I also remember that she had a perfectly good reason for this unusual scale, which does not, in any way, detract from the standard of her craftsmanship. It is excellent throughout, clean and well-finished, although, perhaps, I rather marvelled at the miracle of a fresh breeze at the mast-head and light airs at sea level. The *Green Lady of the Atlantic*, R.M.S. *Caronia*, is the subject chosen this year by D. McNarry at his usual scale of 50 ft. to 1 in. To new readers, I want you to picture in your mind's eye, what it means to work at this scale, when putting in all detail work. For example, in the iron-rung ladders up various masts and Samson posts, a scale of 50 ft. to 1 in. means that the space between the rungs is 1/50 of 1 in. And the rungs themselves, look quite natural and appear to be the correct diameter. Normal people looking at such a model would not even notice the ladder itself, let alone the spaces between and if the rungs were a very dark colour they would not be seen except through a glass. This gives an indication of the work of many of our leading miniaturists of today. For example, as a further indication of such work, Mr. McNarry in his lifeboats on a similar type of ship last year had no less than 73 parts for each lifeboat. Each lifeboat, of course, is round about 1 in. in length. His colouring and finish are quite superb, and is in keeping with the rest of his work.



"The Green Lady of the Atlantic," R.M.S. "Caronia" by D. McNarry (of Barton-on-Sea). One of the few Silver Medallists in the miniature class, at a scale 50 ft. to 1 in. Unlike most modellists Mr. McNarry has his lifeboats uncovered even at this small scale

An interesting model was Kirby's Severn Trow. This is an example of holding in material form a picture of a vessel now extinct—from active work at least. A nice little scenic, by Elve, of Dover, was that of the cross-Channel steamers *Canterbury* and *Invicta* passing each other in the Channel. An outstanding model, by reason of its setting, as much as anything else, was that of Anthes, of Sheffield, with his M.V. *Christianholm*, hove to in a West Indian hurricane. Mr. Anthes has here captured the very essence of such a scene. The ship is a five-hundred footer of, perhaps, 8,000 tons deadweight. Yet she is shown in a perfectly natural setting, just reaching the crest of one huge wave. There is only one wave in the whole 1,000 ft. scene. The hurricane force of the wind



The "Great Western" by Mrs. Iris McNarry, a Silver Medallist in the miniature class and also the winner of the "Hampshire Special Prize." A fine piece of work in an excellent setting. Scale 1 in. equals 28 ft.

is clearly indicated by the flattened out crests of the small subsiding waves of 10 ft. or so in height. But one thing has beaten Mr. Anthes and indeed any modeller. It is almost impossible to show the effect of the flying spray in suspension which just appears as a sort of haze, maybe bridge high. Apart from this haze, Mr. Anthes has captured everything in such a setting and this has been remarked on by many deep-water seamen already who have seen his work.

Lewis, of Birkenhead, on the other hand, makes all his models mounted on supports and to the same unusual scale of 75 ft. to 1 in. His work, for many years, has been characterised by an extremely careful attention to detail, excellent finish, and he attains the still-life mood which is in vivid contrast to that of the Anthes model just described. A very unusual miniature is that of a steamer being towed into a floating dock by a diesel tug, by Stannard, of Leyton. At first glance this looks like a couple of ships passing between two small piers, having no visible means of support to any land. Actually it is just the two sides of a huge floating dock which is in a submerged position ready to take on all comers. It it unusual subjects like this which make the exhibition so interesting to all, whether modellers or just casual onlookers.

Petrol Engine Topics

(Continued from page 411)

positive register to locate the timing case, so that the shaft aperture is concentric, it would not be discreet to attempt to use a close-fitting bush here. A spiral groove is provided on the outside of the sleeve, the exact pitch and depth of which is unimportant; its object is to draw back into the case any oil which may creep along the shaft. As the engine (in the form shown on the drawings) is intended for anti-clockwise rotation at the timing end, a right-hand spiral is employed; but should the engine be changed end for end, to reverse rotation, the spiral should also be reversed, or in other words, made of left-hand pitch.

It has been pointed out by one of my friends that the arrangement of the timing pinion, hard up against the main bearing, is not strictly correct practice, and that the shaft journal should be extended a little at the shoulder to carry the pinion well clear of the bearing. In view of the limited space in the timing case, however, I have not found it desirable to make the orthodox allowances, and so long as the pinion does not actually bind against the bearing when forced home against the shoulder, no harm will be done In these small engines, a certain amount of end play nearly always develops fairly quickly, and in no case should end thrust be taken on the engine shaft, so there should be no risk of the sides of the pinion teeth being forced against the end of the bush.

(To be continued)

Making Spinning Baits

by "Blue Devon"

IT is estimated that there are some three million anglers in the British Isles alone. It would, therefore seem reasonable to suppose that quite a fair proportion are to be found among our readers. At any rate, there must be many with fishermen friends who would welcome presents in the form of an item of fishing gear which is expensive to buy, and on which the wastage is high.

Spinning is a form of angling becoming increasingly popular for coarse fish, such as pike and perch, and, of course, it is regularly employed for game fishing for salmon and trout. While there are many types of bait used for spinning, undoubtedly one of the most popular and efficient is the artificial minnow. In essence, this consists of a torpedo-shaped body, bored through the axis, to which are attached two fins and a mount, carrying a treble hook. Baits can be made of many materials, but wood, brass or aluminium are those most usually employed. In this article it is proposed to describe in detail the construction of the wooden minnow, both because it is easy to make and because of its general utility. To anyone possessing a small lathe and an elementary knowledge of wood turning, its manufacture should present no problem. Furthermore, the materials required are inexpensive and readily available.

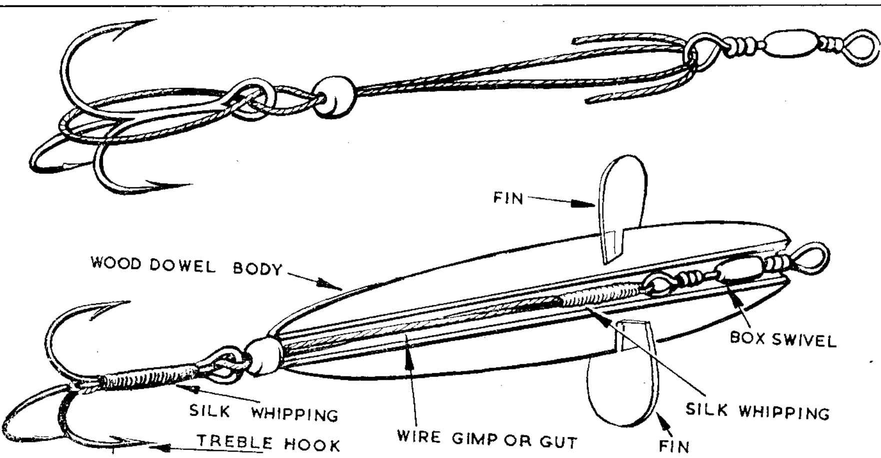
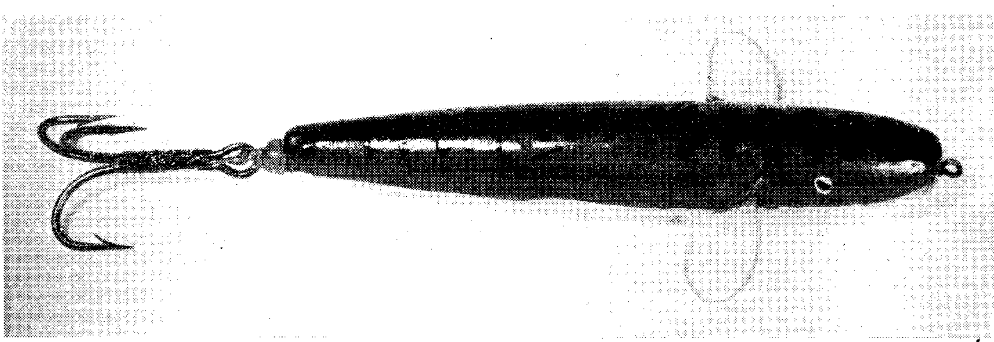


Fig. 1

The bait consists of two parts, the body and the mount (Fig. 1). The purpose of the body is to induce the fish to " have a go." It is the object of the mount to keep him attached to the line after he has had a go at the bait.

The body can be made to almost any size, but



lengths from about 3 in. to $1\frac{1}{2}$ in. should suit the needs of most anglers. It is, however, convenient to make bodies of standard sizes, such as 3, $2\frac{1}{2}$, $2\frac{1}{4}$, 2, $1\frac{3}{4}$, and $1\frac{1}{2}$ in. Thus, if mounts are made to fit these sizes they will be interchangeable.

For the body the materials required are $\frac{1}{8}$-in. bore brass tubing, $\frac{1}{2}$ in. or $\frac{3}{4}$ in. beech dowelling and celluloid or acetate sheet about 1/32 in. thick. While no doubt the reader will devise his

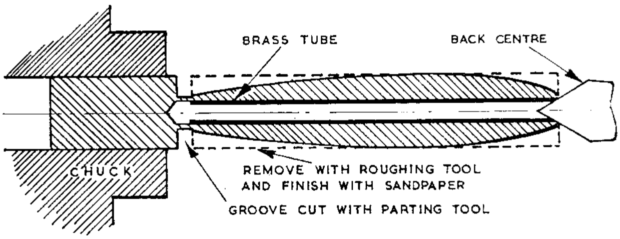


Fig. 2

own technique for procedure, the following method is both speedy and convenient.

Start by cutting off a piece of brass tubing to the length of the body to be made. Next, cut off a piece of dowelling about 1 in. longer than the tubing and grip it in the chuck. Then with a twist drill, bore through the axis a hole of a size to ensure that the brass tube is a force fit in the bore. The size of bore will depend on the external diameter of the tube being used. The bore should be drilled slightly longer than the length of the tube.

Remove the dowel rod from the chuck and, with a soft-nosed hammer, drive the brass tube into the bore until it is flush with the end of the dowel. Then replace the dowel in the chuck and bring up the back centre to engage the end of the brass tube as a steady (Fig. 2). The dowel is now turned into a torpedo shape. The maximum diameter will, of course, depend on the length of the body being made, but it is not critical. The usual form is that shown in Fig. 1. It is a matter of taste whether slim or portly bodies are preferred. The latter, however, are more buoyant.

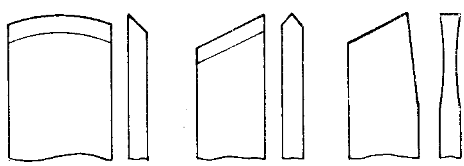
As regards the turning, for those who are unfamiliar with wood turning, three tools only are necessary—a roughing-out tool, a skew chisel for finishing and a parting-off tool (Fig. 3). The last-named, though not absolutely necessary, is a great convenience. All three can quite well be made from old files, suitably ground.

If a deep groove is first cut with the parting tool opposite the inner end of the tube, it is easier to gauge the shape of the body (see Fig. 2). The body is first roughed out with the roughing tool, and finished with the skew chisel. After sanding to a smooth finish, two saw cuts at 45 deg. to the axis, to take the fins, should be made at opposite sides of the body at its largest diameter. It is easier to do this actually in the lathe. The body is then parted-off and the tube slightly countersunk at each end. The fins can be made of celluloid or acetate sheet, or brass. The writer prefers the former because they can be cut to shape with scissors and are easier to secure than brass (see Fig. 1). Also, they give a truer fish-form when spinning, as the fins are transparent. Kinking of the line, due to twist, is an inherent problem when spinning, the usual cure being to reverse the direction of spin. It is therefore advisable to vary the turning direction of baits. Some should be made left-handed, and some right-handed, by setting the fins accordingly. Celluloid and acetate fins can be secured in position with a suitable cement such as Mystic, but they must be a tight fit in the saw cuts.

Apart from painting, the body is now complete. It is important that care be taken over painting, as baits are subject to a lot of hard use and liable to chip. Many different colours are suitable, such as half blue and half silver, half gold and half silver, half blue and half white, etc. Probably the best method is to give an undercoat and follow with high gloss enamel, with a coat of clear varnish to finish. Cellulose paints can also be used, but do not stand up so well to wear. Commercial baits are usually given eyes but these are, of course, quite unnecessary from the fish-catching point of view, and intended purely to catch fishermen!

It only remains to make the mount. From what has been said above it will be appreciated that the mount plays a very important part, and it is most essential that the greatest care is taken in its construction. Disintegration may result in the loss of a fish. At 10s. a pound, the loss of a 20 lb. salmon can well be a financial disaster. Treble hooks and swivels are difficult things to make and, as they are cheap to buy, the amateur will be well advised to purchase them. Do not economise, however, buy the best procurable.

As will be seen from Fig. 1, the mount consists of an eyed treble hook, a piece of wire gimp or, as alternatives, stranded phosphor-bronze,



Roughing-out tool *Skew chisel* *Parting tool*

Fig. 3

or stout gut, a small round bead and a swivel. The swivel should be less than $\frac{1}{8}$ in. diameter to pass freely through the bore, and only the eye of the swivel should project beyond the nose of the body. The wire or gut should be doubled round the bend of the hook and both parts passed through its eye, through the bead, through the eye of the swivel in reverse direction and the ends doubled back. Close whippings should be made round the hook shank and round all four parts close below the eye of the swivel to cover the ends. A number 50 silk, well waxed, is suitable for the purpose, but the finished whip-

(*Continued on page* 421)

*TWIN SISTERS

by J. I. Austen-Walton

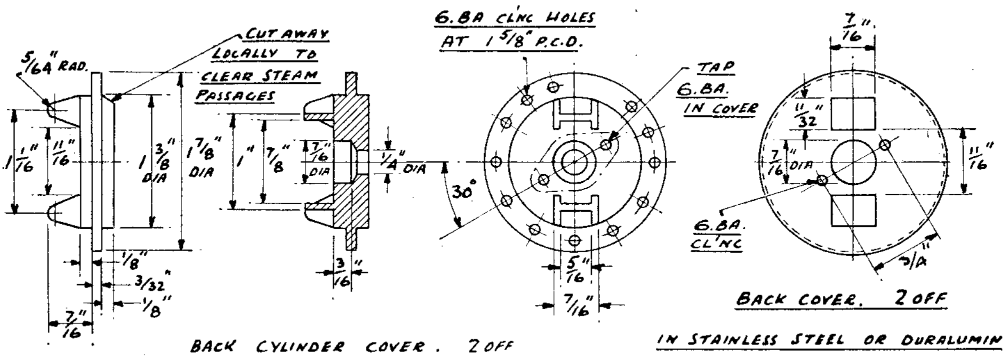
Two 5-in. gauge locomotives, exactly alike externally, but very different internally

THERE are a number of other drillings and tappings to be made in the steamchest, and builders would do well to study the drawing quite carefully. First and foremost, the steamchests are "handed"; this means that one chest is machined exactly the reverse way round to that shown. One would think that this point was terribly obvious, but believe me, it is only too easy to trip up, and there is a lot of metal to waste in a steamchest. Only last week, when making up some brackets I made this very mistake myself, and had to un-braze the bushes I had silver-soldered in, and you would think that I would know enough not to fall into that trap!

Let us examine some of the drilled holes, and comment on them. The largest tapped holes are those for the steam pipe, shown as being $\frac{7}{16}$ in. × 40; you were forewarned about this thread, and advised to get the necessary screwing tackle. Any coarser thread might weaken the thin wall of the pipe. There is still one alternative here, though not mentioned on the drawing; if you care to put a plain hole in the chest, of a size that will allow the copper pipe elbow to be lightly pressed in, it will work quite well. Later, when the inside pipe runs are made and tried up, you will have to secure the elbow section by silver-soldering it into the steamchest. But this will not remove the need for the same screwing tackle when you come to fit the exhaust elbow, where silver-soldering will be quite out of the question.

The stud holes are quite straightforward, the drawing showing clearly where one is missed out to avoid the steam elbow, and that leaves us with the dummy studs and nuts fitted to the false end-plates on the chest. The drawing shows one end so treated, but it implies that the front end should be dealt with in a similar manner. "Minor" builders can skip all this detail if they wish—it is purely a matter of choice, once more.

The front valve spindle guide is a simple turning job, and calls for no special comment. The thread specified could be of another pitch if desired, because once in place it will be soft-solder sweated in permanently, or until wear and tear makes its replacement necessary. For the moment, I can think of nothing else of importance to put forward in the cause of steamchests.



BACK CYLINDER COVER. 2 OFF
HANDED — RIGHT HAND DRAWN.

BACK COVER. 2 OFF
IN STAINLESS STEEL OR DURALUMIN

Cylinder Covers

Here we have some further "handed" items, but only because of the drillings which are so disposed as to miss the steam passage entry to the cylinder. We could, therefore, carry on with the straightforward machining of the parts, dealing with the drillings later. At the moment, castings are available for the front covers only, but those who belong to the "fabrication brigade" can utilise the same castings throughout.

There is a very good reason for this hold-up, which has its origin in the accepted fact that small flat pockets, when cast, are apt to emerge in anything but a flat and clean condition. I refer to the two pockets that house the ends of the guide-bars, and which must be of a shape that provides true alignment with the working centre piston-rod hole, and reasonable equidistance of their seating faces to that centre. This is not a situation that permits of end-milling, due to the difficulties of getting into the sharp corners, and the use of punch shapers or slotting machines I have ruled out completely on the grounds that

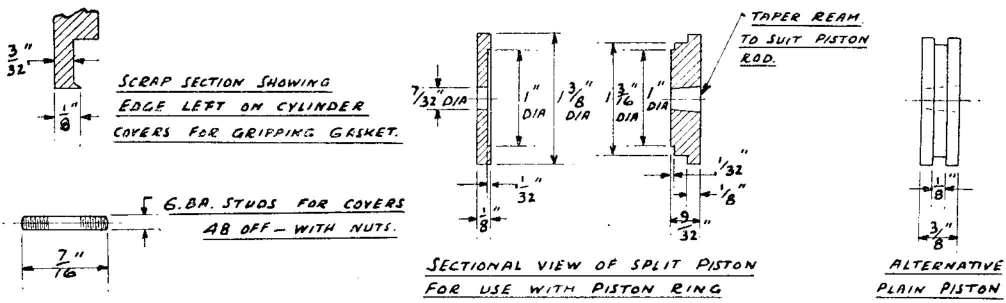
*Continued from page 340, "M.E.," August 31, 1950.

such machines are usually inaccessible. My original pattern had a heavy ring cast all round the face, having a profile the same as the lug outline when finished. When the cover was machined, this ring was entirely milled away, leaving the correctly-shaped lugs top and bottom.

They were also milled out in between, so as to leave four thin ears of metal, the gaps between them just accommodating the finished width of the guide-bars. This gave perfect centralisation

lights it is extremely difficult to tell "which from 'tother," especially after the "buff" had done some work on them. They could, of course, be knocked up from stainless steel sheet, the turned up former being a matter of a few minutes to make, so take your choice.

The front outer cover is fixed by a single 10-B.A. stud and nut, as shown on the drawing, whilst the rear cover is held in place by not only the ends of the guide-bars when fitted, but also



and equidistance, whilst spacing in the other plane called for two tiny platforms of metal, "jig-silver-soldered" in place, and no other machining being necessary.

I discarded this on a commercial basis, not because it was unsatisfactory—the reverse was the case—but because it entailed the removal and waste of quite a lot of metal that *you* have to buy. I propose, therefore, to let friend Kennion have this pattern, for those who do not mind the extra metal, and to ask him to prepare another, simpler pattern, having a couple of solid blobs or lugs, capable of being milled out in the gap. This is definitely a case where diecasting would provide the perfect answer, but the numbers required would not justify the initial expense; so that's that.

The machining of the covers is a simple operation, especially with the chucking pieces on the castings, which enables the bore and the "register" to be done at a single sitting, whilst the register is of such dimensions that the cover is capable of being held in the chuck quite safely for the machining of the outisde face. Apart from the choice of glands, there remains only the spacing-out of the stud holes. This information is given in very full detail, allowing for the use of "standard" or commonplace angles where possible. Owners of dividing-heads and other paraphernalia may prefer to divide up the available spaces equally, it means, in simple terms, that twelve studs have to share out the load as equally as the space permits, and nothing more.

There are also "covers for the covers," in a manner of speaking, and might almost be termed optional features. The prototype has them, as every decently turned out engine should, and I like to see them fitted and kept clean and bright; it would be asking a lot to specify stainless steel for these, owing to the expense and waste of metal entailed. I admit to having used this material on my own engine, but friend Duncan dug his heels in, and asked if he could use duralumin, which was agreed. In some

by the two gland studs that are fitted to tapped holes in the inside, or "real" cover.

Pistons and Rods

Here we meet a little more complication, and even more alternatives, but all designed to meet every taste and need. "Minor" builders might almost ignore the drawing entirely (except for piston width, and rod lengths, which are important, of course) and make the piston a simple grooved disc of metal, with the piston-rod screwed into it. If this were done the recess in the front cover would have to be filled with a flush metal plug, to avoid waste steam space.

Going to the other extreme, the piston made in two halves, and fitted to a taper-ended rod, is for use with a piston-ring. This method of construction disposes of the need for forcing the ring over the piston, an operation that has, at times, distressing consequences. The usual disadvantage with the divided piston is the difficulty of getting the two separate halves to register with each other. If the parts are made as shown, and the 1 in. dia. register portions fit each other tightly, then the trouble has been laid, especially if all the turned diameters are done at one chucking, which they should be, in any case. Dividing the piston has also a distinct advantage, in that if the width of the piston ring groove is made, or becomes too wide, the remedy is fairly simple.

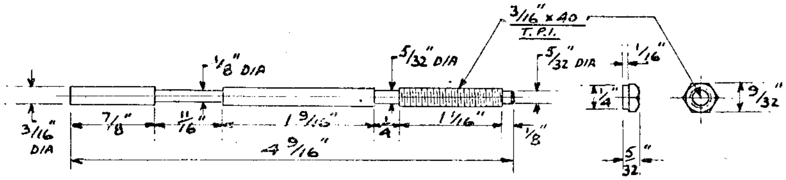
Alignment, being an all-important aspect of this part of the works, is further aided by fitting the piston to a tapered rod; this possesses two further advantages, first that the piston can be removed and replaced repeatedly on its rod, without going "cock-eyed," and secondly, that the joint itself is completely steam-tight at all times.

There is very little trouble in making up the parts from the machining point of view, and calls for a silver-steel "D"-bit to be made; this *must* be turned at the same top slide setting established when turning the taper on the rods.

And now the rings; I am using a "Clupet"

ring, which is virtually endless, in that it goes round twice, performing some queer antics on the way, but presenting what amounts to a jointless band of metal, and no gap to worry about. This is the " de luxe " ring to my mind, suitable for cast-iron or Meehanite cylinders.

machining operations, this would be the proper place to deal with the areas of the steam-ways generally. Assuming that the heavier of the two gauges of pipe specified is being used, the internal cross-sectional area of the $\frac{5}{16}$ in. dia. is 0.076 sq. in. The actual ports, where cut to the $\frac{5}{8}$ in.

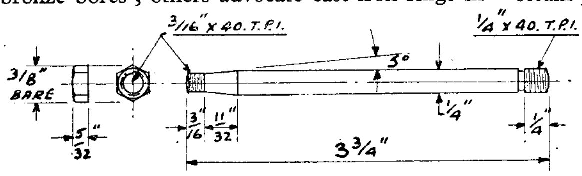


VALVE ROD. 2 OFF IN STAINLESS STEEL.

VALVE ROD NUTS 4 OFF

You could make up your own ring with a simple split, just like the ordinary petrol engine type, and provided the gapping and fitting were carried out correctly, it should perform quite well.

I have somewhat mixed views on the subject of piston-rings in gunmetal or bronze cylinder bores, and reports are quite confusing as well. Some say that they have obtained wonderful results with phosphor-bronze rings in phosphor-bronze bores ; others advocate cast-iron rings in



PISTON ROD & NUT. 2 OFF EACH IN STAINLESS STEEL.

gunmetal bores, and one or two declare that any rings tear up the surface of the bronze or gunmetal.

My own personal view is that much depends on the quality of the workmanship involved, to say nothing of steam temperatures, lubrication, or the lack of same, and last, but not least, the standards on which the advocates base their claims.

Fortunately, I included the simple type of piston, round which may be wound string, mending wool, tarred rope, graphited yarn, leather bootlaces, or whatever the builder fancies or has faith in ; believe me, I have found specimens of all the above packings from time to time, plus a few others that had the texture of liquorice, but not the flavour !

The outer ends of the piston-rods are threaded for a short way, not really as a means of attaching the crossheads, but for reasons of initial adjustment, so that the piston will have perfectly equal clearances at both ends of the stroke. There will be fitted the correct type of flat cotter, which has proportions better suited than the usual round pin to the taking of end loads.

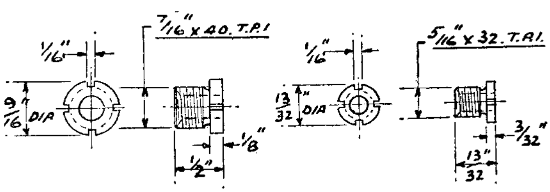
Port, Passage and Pipe Areas

As we are returning to the cylinders in order to consider the cutting of the ports, and other

long openings as shown, will have an area of 0.078 sq. in. and the exhaust port twice this figure. Three No. 18 holes drilled for the steam passages, gives a total rea of 0.672 sq. in., which proportion I consider to be best suited for the job in hand.

Should any builder wish to embody the longer ports, dotted in on the drawing, and shown extended to $\frac{7}{8}$ in. long, he could also enlarge the steam passages if he felt there might be excessive restriction. $\frac{3}{16}$ in. dia. holes would give a total area of 0.0081 sq. in., whilst three such holes, milled or routed out into one channel would represent the extreme limit of safety coupled with mechanical strength (to my mind).

The ports are drawn with square ends, but as builders are more than likely to be using an end-mill for the machining, they can be left with rounded ends ; the loss in effective area is hardly worth



ALTERNATIVE SCREWED GLANDS 2 OFF. EACH — IN G.M.

worrying about. The cavity in the slide-valve would also be machined more conveniently with the aid of an end-mill, so let us assume this method will be the order of the day.

The spacing of the ports is completely conventional, that is, exhaust port twice the steam port, port bars equal to port. As a matter of interest, the valve lap is a bare $\frac{1}{8}$ in., or if you like, a full 0.1 in., but that figure will settle itself according to the way the valve-setting works out, taking into account some backlash that is always present in some small quantity, however well the gear is made.

For the benefit of the mathematical folk who will want to know more about the drilling of the three holes for the steam ways, I did work out the

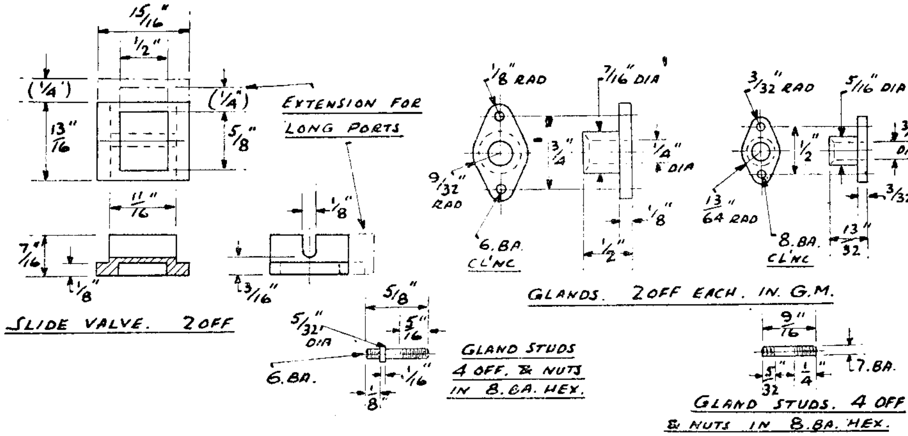
angles relative to the horizontal. The hole nearest to the top, and centre line of the cylinder bore, should be 15 deg.; the next in order, 17 deg., and the last, or outer hole, 22 deg. However, I hesitate to tell you to set up the cylinders strictly to these angles, and guarantee success; much depends on how the holes are started, and the behaviour of the drill in transit, so please regard these angles more as a guide than anything else.

Slide-valves and Rods

Once more, the drawing shows the alternatives in valve widths, and it will be noted that nothing else is altered.

The short valve has the advantage of retaining a truly central drive, which is the greatest aid to retention the of accurate valve timing. The drive to any slide-valve must always be free from end-float, yet allow the valve perfect freedom in the up and down plane. In theory it is quite simple, but in practice there is a distinct snag when the valve tries to lift at one end and stay put the other, resulting in a mild form of jam. The correct type of buckle, entirely embracing the valve, does not improve the case at all; in fact, the further apart are the driving or contact faces, the greater the tendency for it to get stuck up.

The nearer the middle of the valve, and the shorter the actual driving part on the valve rod, provided that some provision is made to prevent the valve slewing round, the better it will perform its work. If any builders would prefer to use a buckle in place of the drive shown, they should reduce the top part of the valve as far as the valve cavity will allow, and so avoid the trouble mentioned. The buckle should have the forward rod made permanently into it, and the after, or main driving portion made to screw into the other end. There is no snag except getting perfect alignment between the two rods, and those confident enough in their own standard of work, can go right ahead. Some experts will most probably criticise the method of drive I have employed, on the grounds that the actual bearing contact between the rod and the valve is so small. I am quite alive to this, and the possible though not probable results through long wear and heavy loading; should this turn out to be a trouble spot in the future, I have a simple form of modification that could be effected quite easily; but for the time being, I am confident in letting it go through as it is.



This Week's Afterthought

And a very recent afterthought, too. Harking back to the cylinder covers, and the small scrap section showing the ridge left for gripping the gasket, this is perhaps a shade exaggerated. Leave just enough ridge to grip the gasket, and not cut right through it in other words, use your own judgment.

(To be continued)

Making Spinning Baits

(*Continued from page* 417)

pings should be coated with spirit varnish as a protection against water.

The size of the treble hook naturally varies according to the size of bait, and is largely a matter of choice. However, a table of suitable hook sizes is given for various sizes of baits :—

3 in.	body	No. 4 hook
2½ in.	„	„ 6 „
2¼ and 2 in.	„	„ 8 „
1¾ and 1½ in.	„	„ 10 „

Some difficulty may be experienced in obtaining suitable beads, in which case they can be turned from brass rod.

As a tip to the fisherman, mounts should be discarded at the first sign of rust or, if of gut, as soon as any fraying occurs. The hook, bead and swivel can, of course, be used again.

As an alternative to wood, bodies can also be made out of brass. For this type, however, the brass tube is, of course, unnecessary. It is easier to fix brass fins in this case, as they can be sweated into the saw cuts. It is important to make brass baits as light as possible. Drilling out to slightly more than ⅛ in. bore and keeping the body slim will usually have the necessary effect.

Novices' Corner

Squares

THE ordinary engineer's square is usually known as a try-square because, perhaps, it is commonly used for testing surfaces to determine whether they are at right-angles to one another. Nevertheless, the square is probably employed just as often for scribing lines at right-angles to a datum surface in the process or marking-out work for machining, in the same way as a set-square is used on the drawing board.

As shown in Fig. 1, the ordinary plain square consists of two parts: the stock and the blade; these components are firmly secured together with accurately fitted rivets, and sometimes the blade is given additional support by means of a soldered joint. In some of the more expensive types of squares, the blade is fixed to the stock by means of screws, in order that the blade can be reset more easily when adjustment becomes necessary after prolonged use.

When testing the squareness of a surface, any angular error or surface irregularity will be more readily detected if the blade makes a line contact only with the work. This is provided for by bevelling both sides of the two edges of the blade so that only narrow knife edges remain. A square of this type made by Messrs. Brown & Sharpe is shown on the left of Fig. 2, but Messrs. Moore & Wright also manufacture these precision squares with bevelled edges. A further elaboration of the blade design is to add graduations as an aid to marking-out; a graduated square which, incidentally, is more than fifty years old can be seen on the right of Fig. 2.

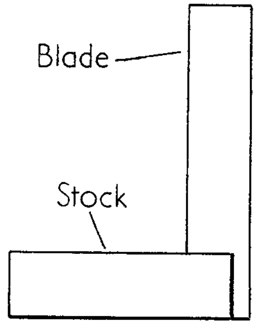


Fig. 1. Parts of the try-square

If a square is to resist the wear that may result when it is used in marking-out operations to guide the hardened point of the scriber, it is essential that the blade itself be hardened before being finished by grinding; the hardening of the

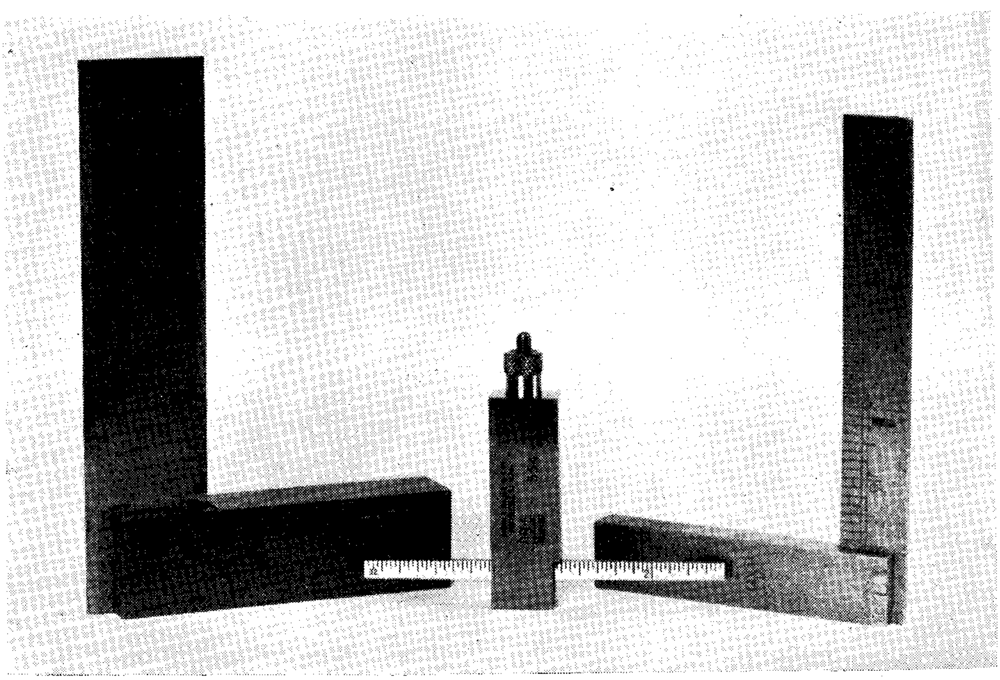
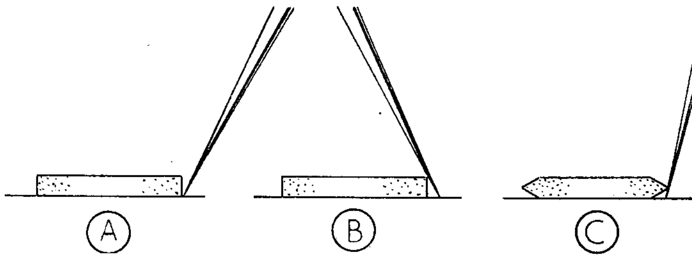
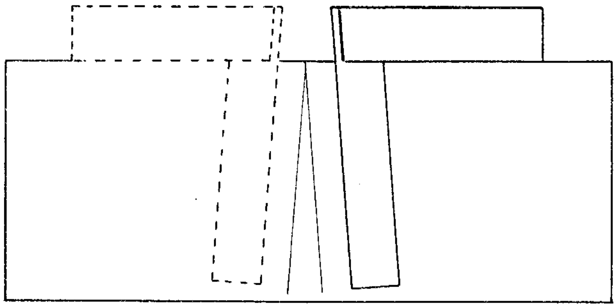


Fig. 2. Three types of try-squares

Right—Fig. 3. Showing : A—correct way of applying the scriber ; B—incorrect method ; C—lack of guidance with a bevelled-edge square



Below.—Fig. 4. Method of testing a square



blade is, of course, particularly important where the edge is narrow, as in the square with bevelled edges.

When employed for marking-out work with a scriber, the square should have a flat-faced and not a bevelled edge. The reason for this will be made clear by the diagrams in Fig. 3. The one at *A* illustrates how the scriber point should be applied to the blade of the square to obtain proper guidance, but if the scriber is held as shown at *B*, the marking-out line may then be drawn at some indeterminate distance from the edge of the blade. It is for this reason, too, that a bevelled-edge square should not be used for marking-out, for, as shown at *C*, the position of the scribed line will depend on the angle at which the scriber happens to be held, and this may not even be constant.

The small toolmaker's square manufactured by Messrs. Brown & Sharpe, and illustrated at the centre of the group in Fig. 2, is furnished with a narrow graduated blade that can be adjusted lengthways in the stock when the clamp-screw is slackened ; this enables the square to be used in confined spaces where the blade of even the smallest size of plain square might be found too long. In addition, this square is equipped with a second detachable blade having its ends formed to 45 deg. and 30 deg. for testing and marking-out angular work.

Although the squares already mentioned will serve for all ordinary work, there are many other patterns listed in tool manufacturers' catalogues and, of these, the most generally useful is, perhaps, the combination square consisting of a rule or graduated blade, 9 in. or more in length, on which are carried an adjustable stock and a protractor head, as well as an angular head for scribing centre-lines on round material. A square with an adjustable blade of this length will be found a valuable item of workshop equipment, and the spirit level with which the stock is fitted adds greatly to the tool's utility.

Testing a Square

Precision squares are submitted to a very exacting test in a physical laboratory before a certificate of their accuracy is issued, but, needless to say, any square of reliable make will have been fully tested for accuracy in the factory before being passed by the manufacturers. Should a square, however, have been subjected to ill usage, its accuracy may have to be checked. This may be done by comparison with another square of known accuracy, or the following geometric test may be applied to determine whether or not the tool is fit for ordinary use. In the first place, a piece of material with a straight edge is required, having a length rather greater than that of the stock. The way in which the test is carried out is illustrated in Fig. 4. The surface of the test-piece is painted with marking fluid and, with the stock of the square pressed against the straight

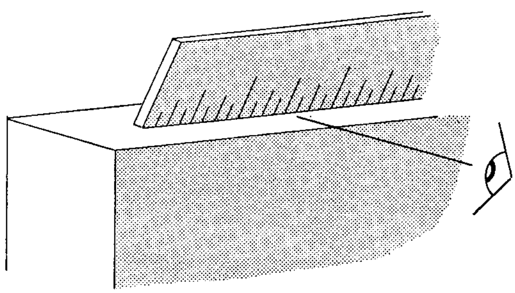


Fig. 5. Using a rule to test a flat surface

edge, a fine line is carefully scribed with a sharp, finely-pointed scriber. The square is then turned over and a second line is scribed only just clear of the first. Any divergence of these two lines can readily be detected by eye and will indicate that the square is out of truth.

Should the edge of the test-piece, however, not be straight, the test will be of no value. A simple way of testing the straightness of an edge

or the flatness of a surface, sufficiently accurate for ordinary purposes, is illustrated in Fig. 5.

A best-quality rule, having ground edges, is applied to the work and held against the light at eye level. If the work is flat, as the rule is tipped forward the lower ends of the graduation lines will appear as evenly spaced dots of bright light separated by dark intervals. If, on the other hand, the work surface is irregular, these bright dots will be seen only in the places where the rule is making proper contact. When testing small pieces of work in this way, the 1/32 in. graduations should be used, but for larger work the $\frac{1}{16}$ in. or $\frac{1}{8}$ in. graduations will serve better. If the rule happens to be bent so that its flat sides are not truly flat, the test may then give a false reading, but this can be checked by turning the rule end-for-end and sighting it afresh. A rough test of a rule's flatness can be made by resting the rule on a surface plate and tapping it with the finger-nail; if even contact is being made, the sound will be similar to that emitted when the surface plate itself is tapped, but a higher-pitched note will indicate that there is an air gap between the rule and the surface of the plate.

This, incidentally, is quite a useful method of testing the flatness of other forms of material on the surface plate.

PRACTICAL LETTERS

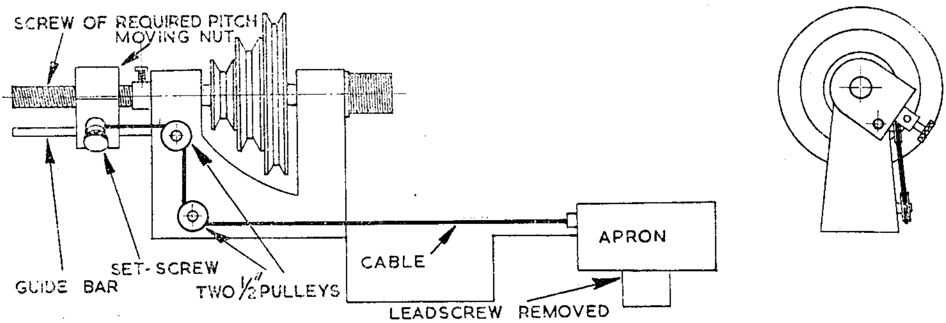
Screwcutting in the Lathe

DEAR SIR,—This is a suggestion for those who own the small simple lathe and wish to screwcut without the expense of the various change-wheels or stocks and dies.

The device, which I have not seen before, consists of a piece of screwed rod (of the pitch to be cut) which is turned to fit in the end of the mandrel, and affixed with a set-screw. On this either run at a very low speed or hand turned until the cut is made, the tool withdrawn and the nut wound back for another cut to be taken. Two or three screws of varying pitches can be made. Although this is, of course, no substitute for the proper system, it does enable the simple lathe owner some scope for screwcutting.

Yours faithfully,

London, E.1. S. W. BOOTH.



rod is a nut of the section shown which is free to travel the length of the screw. A guide consisting of a length of rod is screwed to fit into the lathe headstock (this is essential to stop the nut turning) and the nut drilled a sliding fit. At the base of the nut a drilled pillar is fitted with a locking-screw (an electric terminal is ideal). On the headstock, two small pulleys are fitted (Meccano type will do) the top one in line with the hole in the pillar of the nut and the bottom in line with a fixing point on the lathe apron. To this fixing point a length of flexible cable, such as used on the three speed of a cycle, is attached, taken round the pulleys and through the anchor hole on the nut.

In use the lead screw is removed and the apron made an easier slide. The screwcutting tool is brought to the commencement of the work and the cable pulled taut through the anchor and the set-screw tightened. The lathe is

Mr. Davies's "Advance-Rumely" Traction Engine

DEAR SIR,—I owe an apology to Mr. W. E. Davies, of Swindon, for ascribing his model "Advance-Rumely" traction engine to Mr. J. Davies, in my article on the traction engine models at the "M.E." Exhibition. This was due to a combination of circumstances which would take too long to detail here, but I hope that both these gentlemen will forgive the error.

To keep the record straight, then, the "Advance-Rumely" was built by Mr. W. E. Davies, and Mr. J. Davies has just completed an "Aveling" traction engine, which is the engine referred to in the last paragraph of my article, and also in the sentence stating that "no scale drawings were available, and it is built from photographs and other information."

Yours faithfully,

Sheffield. W. J. HUGHES.

International Power Boat Regatta

DEAR SIR,—As competitors at the above regatta held at Derby on August 12th and 13th, we should like to pay tribute to the M.P.B.A. and the Derby club with special commendation to G. Stone and E. Clare for their personal efforts in making this event such an outstanding success.

It was a great pleasure to meet again Mons. and Madame Suzor, also the brothers Chevrot with their charming ladies.

Also, may we say how much we all appreciated the sportsmanship of Sir Robert and Lady Bird whose generosity and enthusiasm made possible such a delightful gathering at the Midland Hotel.

While congratulating the winners on their success, we should like to express our sympathy with George Stone on not being able to show his boat's true paces until after the event was concluded.

We hope our visitors from the Continent enjoyed their stay in England and that they have taken home pleasant memories in addition to the trophies.

Yours faithfully,
K. G. WILLIAMS.
Birmingham. T. DALZIEL.

A Useful Copper Alloy

DEAR SIR,—I wonder if any of your readers have experimented with the use of Barronia alloy in connection with flash steam. This material which is manufactured by Barronia Metals Ltd., Power Road, Gunnersbury, London, W.4, contains 85 per cent. of copper, 9 per cent of zinc and 5 per cent. of tin, with other constituents making up the remaining 1 per cent. Its outstanding feature is its high resistance to corrosion, coupled with good mechanical properties which are maintained to a remarkable degree at temperatures ranging up to 1,000 deg. F. While it is not usual to weld it, it can be soft- or hard-soldered, usually without special flux, and can be annealed by heating to a bright red and quenching in water. It machines readily, either with or without cutting lubricant. I have not tried it in connection with flash steam, having no facilities at present to do so, but I feel that it may solve quite a few of the problems connected with the use of high temperature steam.

To revert to another subject, how does the engine in Mr. J. C. Piquet's submarine work (see the letter in July 20th issue) if the pressure on both sides of the piston is the same? I imagine it could possibly do so if the engine were double-acting, but the engine illustrated is single-acting.

Congratulations to Mr. Keiller for his excellent article on his compound locomotive. It is very interesting and extremely refreshing to read an article by a writer who obviously spares no pains in finding out a reason for everything.

Yours faithfully,
Iver. H. BRISTOW

CLUB ANNOUNCEMENTS

The Society of Model and Experimental Engineers

The new headquarters of the Society of Model and Experimental Engineers at 28, Wanless Road, Loughborough Junction, will be officially opened by the president, The Lord Forres, on Saturday, September 30th, 1950, at 3 p.m All members and others interested are invited to attend.

The premises are within a minute of the 48 and 34 tram routes, and the 35 bus route (Loughborough Junction stop); nearest stations: Loughborough Junction (S.R.), East Brixton (S.R.), and Stockwell (Underground).

Secretary: A. B. STORRAR, 67, Station Road, West Wickham, Kent.

Huddersfield Society of Model Engineers

Our next open event will be held at Highfields on Saturday, September 16th, 1950, when we hope to have some visiting societies with locomotives and boats.

Hon. General Secretary: F. W. L. BOTTOMLEY, 763, Manchester Road, Huddersfield.

Taunton and District Society of Model and Experimental Engineers

The above society held their first exhibition recently in the North Street Congregational Church Hall, Taunton. Highlights of the show were the showman's road locomotive, Burrell traction engine and Garrett threshing machine and elevator made by Mr. F. Bettles (vice-president of the society) and a radio-controlled model of the M.V. *Devonshire* by Mr. C. N. Unwin who returned home on the *Devonshire* when she was a troopship.

New members are always welcome at the fortnightly meetings held at the clubroom at the rear of the above church, at 7 p.m., on alternate Saturdays.

Acting Hon. Secretary: E. H. CURRY, 17, Grays Road, Taunton.

East Grinstead and District Model and Experimental Engineering Society

The annual general meeting of the above society will be held on September 18th at the Oak Room, Whitehall, East Grinstead, at 7.30 p.m. sharp. Will members please let the hon. secretary have their nominations for the committee not later than Friday, September 15th.

Hon. Secretary: VIOLA BARWELL (MRS.), 9, Copse Close, East Grinstead, Sussex.

The Kingsmere Model Power Boat Club

The first annual M.P.B.A. regatta of the above club will be held on Sunday, September 17th, at the Kingsmere, Wimbledon Common, commencing at 11 a.m. Events will be run in the following order:—

500 yd. race for "A" class hydroplanes.
300 yd. race for "C" class (restricted) hydroplanes.
300 yd. race for "C" class hydroplanes.
300 yd. race for "B" class hydroplanes.
300 yd. race for "D" class hydroplanes.
Steering competition.
Towing race.

Hon. Secretary: C. F. MORGAN, 134, Lavenham Road, Southfields, S.W.18.

The Oldham Society of Model Engineers

The above society now possesses, thanks to the efforts of a few members, a good model boat pond on private property, and an almost completed $52\frac{1}{2}$ ft. car track. We have also competed in field events with some success, along with joining in local clubs' exhibitions.

At the request of the joint Co-operative movements of Oldham, we are putting on an exhibition of models at Hill Stores, Greenacres, Oldham, from Saturday, September 30th until Saturday, October 7th. The Lees and Oldham Model Yacht Club will combine with us in this event, which will be held in the Smoke Room and Guild Room. The Mayor is to open the show at 11.30 a.m., September 30th, but week-nights opening times is 6.30 p.m. until 9.30 p.m. We shall have plenty of working exhibits plus static ones, and hope to renew old acquaintances and make many new ones through the medium of THE MODEL ENGINEER. The only displeasing feature of our last exhibition was the lack of visitors from districts other than purely local, although attendances were overwhelming. This time we have more space, fresh exhibits, change of venue, and anticipate more response from more distant visitors.

Hon. Secretary: F. MILLER, 25, Eric Street, Oldham.

Croydon Society of Model Engineers

The club commences its winter programme on September 14th, with a rummage sale, followed by a "OO" night on September 28th. There has been a lull during August for holidays, but the return of the darker evenings should encourage members to press on with their entries for the half-yearly competition to be held on November 9th.

Hon. Secretary: J. F. STRINGER, 59, Windmill Road, West Croydon.